

GOVERNMENT OF INDIA
ARCHÆOLOGICAL SURVEY OF INDIA
ARCHÆOLOGICAL
LIBRARY

ACCESSION NO. 27132

CALL No. 352.505/E.P.W.M.

INDIA.

PUBLIC WORKS MINISTRY.

REPORT

UPON THE

ADMINISTRATION OF THE PUBLIC WORKS DEPARTMENT IN EGYPT

FOR 1903

BY

SIR WILLIAM GARSTIN, G.C.M.G.,

UNDER SECRETARY OF STATE, PUBLIC WORKS DEPARTMENT

WITH REPORTS BY THE OFFICERS IN CHARGE OF THE SEVERAL BRANCHES
OF THE ADMINISTRATION.

352.505
E. P. W. M.



A217-2

CAIRO

NATIONAL PRINTING DEPARTMENT

1904

LIBRARY, NEW DELHI.
Acc. No.
Date.....
Call No.....

PUBLIC WORKS DEPARTMENT.

ADMINISTRATION REPORT FOR THE YEAR 1903.

My note upon Public Works Administration in 1903, must, of necessity, be a very brief one. Owing to my absence in the Soudan and the preparation of my report upon the Upper Nile Basin, the time available for writing my annual note has been extremely limited. The reports furnished by the heads of the different services concerned are, however, so complete in themselves that very little in the way of observation is required from me. These reports consist of the following:—

I.—*The Irrigation Service.*

- (a) Report by Mr. A. L. Webb, C.M.G., Inspector General of Irrigation, Upper Egypt.
- (b) Report by Mr. K. E. Verschöyle, C.M.G., Inspector General of Irrigation, Lower Egypt.

II.—*Services, other than Irrigation.*

- (c) Report by Mr. A. H. Perry, Director General of Towns and Buildings.
- (d) Report by Captain H. G. Lyons, Director General of the Survey Department.
- (e) Report by Mohamed Pasha Anis, Chief of the Technical Service.
- (f) Report by Monsieur G. Maspéro, Director General of the Antiquities Department.
- (g) Report by Mr. G. Gunn, Inspector for the Agricultural Railways to the Ministry of Public Works.
- (h) Report by Captain Stanley Flower, Director of the Government Zoological Gardens.

EXPENDITURE.

The following tables show the total sums expended in 1903, under the Budget of the Ministry of Public Works:—

TABLE I.

ORDINARY BUDGET.

	L.E.	M.
Central Office	48100	841
Irrigation Branch	618783	912
Towns and Buildings	213029	258
Survey Department	32485	352
Technical Service... ..	15090	531
Antiquities Department	14411	829
Total... ..	L.E. 941901	723

This total is greater by L.E. 7380,927 Mill., than that of the year 1902, the increase being chiefly due to expenditure in Survey Department.

TABLE II.

EXTRAORDINARY BUDGET, OR WORKS EXECUTED UNDER SPECIAL CREDITS.

	L.E.	M.
Zifta Barrage (Caisse money)	98599	079
Drainage Works (Caisse money).	73313	807
Irrigation Improvements (Caisse money)..	479843	845
Public Buildings (Caisse money)	106076	440
Public Buildings (money found by other Departments).	46414	403
Total... ..	L.E. 804247	574

This is less by L.E. 210738,250 Mill. than the expenditure, under the same head, in 1902. The decrease is due to the completion of the main expenditure upon the Zifta Weir and to a large reduction in the credits allowed for Public Buildings.

In addition to the expenditure shown in Table II, certain further sums were devoted to works not included in the above list, the credits for which were derived from various sources. This expenditure I have, as in last year's Report, grouped into a special Table, entitled "Various Extra Credits":—

TABLE III.

VARIOUS EXTRA CREDITS. 1903.

Caisse de la Dette money.

	L.E.	M.
Special low Nile	5488	969
Special low flood credit	2954	865
Rosetta and Damietta Sadds.	8237	266
Museum Catalogue	2601	105
Temple of Karnak.	2374	303
„ „ Philæ	318	728
„ „ Edfu	1168	731
Total... ..	<u>L.E. 23143</u>	<u>967</u>

Money supplied by other Departments and Revenue.

	L.E.	M.
Survey (revenue)	30257	—
Barrage Gardens (revenue and maintenance)	1055	470
Cairo City (revenue)	9087	719
Provincial Towns Expenditure	263	041
Ezbekieh Gardens (revenue)	1	972
Public Buildings (revenue)	2414	964
Total... ..	<u>L.E. 43110</u>	<u>166</u>

The expenditure in this table is less than that for the year 1902, by L.E. 27055.157 Mill. The reduction is chiefly due to the reduced expenditure upon the Nile flood, and the completion of the repairs to the Philæ Temples.

The following table gives a summary of the year's expenditure:—

TABLE IV.

TOTAL EXPENDITURE IN 1903. Tables I. II. III.

	L.E.	M.
Ordinary Budget	941901	723
Extraordinary Budget	804247	574
Various Extra Credits ⁽¹⁾	66254	133
Total... ..	<u>L.E. 1812403</u>	<u>430</u>

	L.E.	M.
⁽¹⁾ —Irrigation... ..	17736	570
State Buildings... ..	11797	696
Survey Department	30257	000
Museum Department	6462	867
	<u>66254</u>	<u>133</u>

The above total is less than that of 1902, by L.E. 230412.510 Mill.

The payments made in 1902, to Sir John Aird and Co. for works connected with the Nile reservoirs, amounted to Pounds Sterling £50767 or L.E. 49497.825 Mill.

Adding this last sum to the figure given in Table IV, the total expenditure controlled by the Department of Public Works in 1903, was L.E. 1861901.255 Mill.

This is less than the total expenditure for 1902, by L.E. 523131.885 Mill.

This diminution is due to the fact that last year, the Reservoir works were practically completed.

I will now describe the progress made by the General Services in 1903, separating my Report into two portions, viz. "Irrigation Works," and "Works other than Irrigation."

Part I.—IRRIGATION WORKS IN 1903.

THE SEASON AND THE WATER SUPPLY.

In consequence of the effect upon the river, below the Aswan Dam, caused by the filling and discharging of the Reservoir, the gauge at Aswan can no longer be made use of during the summer months as a standard of comparison with the river levels of previous years. In future, the gauges at Khartum and at Wadi Halfa will be referred to in any comparative statements of the kind.

The years 1900, 1901 and 1902, were distinguished by abnormally low summer levels, followed, in each case, by a partial failure of the flood. At the commencement of last year, it appeared probable that 1903 too would be included in the same category as its immediate predecessors, namely as a year of bad supply. On the 1st of January, the level at Khartum was only 26 centimetres *higher* than that recorded on the same date in the years 1900 and 1902, and was 10 centimetres *lower* than the reading in 1901. At Wadi Halfa, the water levels were not much better. Although the gauge reading on the 1st of January 1903, was 86 centimetres higher than that of the 1st January 1900, it was only 4 centimetres above that for the same date in 1901, and only 12 centimetres higher than the level recorded in 1902. Consequently, the year 1903 commenced with a river level considerably below the normal. For several months the conditions continued to be unfavourable, going from bad to worse, until on the 17th of May, the Khartum gauge recorded a reading 10 centimetres *lower* than the lowest level reached in the *minimum* year of 1900.

Fortunately, from this date matters began to improve, and a steady rise commenced. This was continued until, on the 29th of May, the level for the same date in 1899 (a year of fair summer supply but of poor flood) was passed. On the 18th of June, a check occurred in the rise which was followed by a slight fall. On the 1st July, the true rise commenced at Khartum.

The flood, however, during the earlier stages, was extremely slow in rising; so much so that, during the first half of the month of August, everything appeared to point to a failure of the Nile flood for the fifth year in succession. By the 15th of August, a great

improvement took place and, by the end of that month, the levels at Wadi Halfa were those of a fairly average year. The fall, after this date, was a gradual one and, by the end of 1903, the gauge at Halfa was nearly 40 centimetres higher than that for the last days of the year 1902.

The year 1903 may be briefly described thus: Throughout the winter and early summer months, the levels were exceptionally bad, but a timely rise in the middle of June improved matters considerably. In the first stages of the flood, the water levels were much below the mean of previous years, but, towards the end of August, they rose so quickly that those of a fairly average year were attained. The flood, however, must be classed as a late one. The fall was so gradual that the year closed with a better prospect for the supply of the following summer, than had been the case for several years previous.

The maximum gauge reading at Khartum in 1903, was reached on the 31st of July, and at Wadi Halfa on the 25th and 26th of August, when 8.20 was recorded on the gauge.

ASSISTANCE RENDERED BY THE ASWAN RESERVOIR.

Throughout the period of low summer supply and, whilst the Khartum levels were at their lowest, the discharge of the river, north of Aswan, was supplemented by the water from the Reservoir, to such an extent that no difficulties, as regards irrigation, were experienced, and but few people in Egypt were aware of how critical at one time the situation promised to become. By the 1st February 1903, the maximum water level, viz R.L. 106.00, was reached in the Reservoir. From that date, until the 10th of March, it was kept full and the river supply was passed through the upper sluices. On the 10th of March, in consequence of the low levels of the river, it was decided to commence supplementing the discharge, by the water stored in the Reservoir.

The following cubes of water discharged and added to the river supply:—

From March 10th to March 26th	1	million cubic metres per diem
.. .. 26th .. May 1st	2	.. .. .. ..
.. May 1st 20th	4	.. .. .. ..
.. .. 20th .. June 3rd	11	.. .. .. ..
.. June 3rd 25th	20	.. .. .. ..

By the end of June, the first rise from the south reached Aswan, and thus maintained the river levels downstream of the dam. Previous to this date they had been artificially kept up by the water from the Reservoir. The discharge of the Nile in June, was only some 20 millions of cubic metres per diem. The Reservoir water therefore practically doubled the available supply, at the most critical period for the irrigation of the summer crops.

The filling and discharging of the Reservoir involves an immense amount of work in the shape of calculation, diagrams, etc., besides constant watching of the river levels and very careful manipulation of the sluices of the dam. Considering that the year 1903 was the first in which the Reservoir was made use of, and that there had been no previous experience to guide them, great credit is due to Mr. Webb, the Inspector General of Irrigation, Mr. May, the Resident Engineer and the whole staff, for their very successful regulation of the supply. With the abnormally low levels and the totally inadequate supply in the river up to the middle of May, there would have been great difficulty in saving the summer crops, had it not been for the assistance afforded by the water stored in the Reservoir. This enabled an ample supply to be given to Middle and Lower Egypt, at least one month earlier than would have been possible had the dam not existed. Canal rotations were relaxed generally early in July, instead of in the middle of August. The prohibition against the irrigation of land for the maize sowings was removed one month earlier than the usual date. Rice irrigation was permitted everywhere and the entire cotton crop was plentifully watered. Lastly, some 170000 feddans of land in Middle Egypt, formerly basin, were given "Sefi" irrigation. The rental and sale value of these lands was consequently largely increased.

MEASURES TAKEN IN 1903, TO ENSURE WATER DISTRIBUTION.

The Asyut Barrage was closed on the 21st of February. The maximum "head" attained on this structure was 1.11 metres. It was fully opened by the 9th of August.

The Delta Barrages were tightly closed by the 10th of April. Up to the first week in June, the supply in the river, upstream of these structures, slowly diminished. After that date, the influence of the Reservoir water was felt and the supply steadily increased. By the 3rd of July, the level of 15.50 metres upstream was reached. This is an all-important level, as regards Lower Egypt, as, until it is reached,

no water is passed down the branches of the river below. It is the maximum level permitted, with all the gates closed. In previous years this maximum has rarely been attained until a month later and it has often been as late as the middle of August. The effect of the Reservoir, combined, it is only fair to add, with an early rise in the south, was to reduce the period of tension to some 38 days, as against from 70 to 110 days in previous years of similar supply.

The earthen "sudd" in the Damietta branch was not constructed in 1903. That in the Rosetta branch, was made as usual. This "sudd" was completed by the 20th of May. A total quantity of 80 millions of cubic metres of water was drawn from the pool up stream of this dam. This was sufficient to give two waterings to an area of some 100000 feddans.

The Arfeh pumps were worked for a total period of 22 days. These pumps are used to supplement the supply of the Mahmudiyyeh canal.

Summer rotations were commenced in Lower Egypt, on the 15th of May. They were removed everywhere, by the 21st July.

Flood rotations, by which alternate periods of high and low supply are given to every reach of the canals, were enforced from the month of August. These rotations have an excellent effect in preventing the flooding of the drains and the consequent swamping of the adjoining lands.

IRRIGATION EXPENDITURE IN 1903.

TABLE I.

ORDINARY BUDGET.

	L.F.	M.
Central Office (including supplementary Reservoir expenditure)	76769	057
Upper Egypt..	209328	755
Lower Egypt..	332686	100
Total... ..	<u>L.E. 618783</u>	<u>912</u>

TABLE II.

EXTRAORDINARY BUDGET.

	L.E.	M.
Zifrah Barrage (Caisse)	98599	079
Drainage Works (Caisse)	73313	807
Irrigation improvements (Caisse)	479843	845
New Weirs (Caisse) ... ..	..	..
Total... ..	<u>L.E. 651756</u>	<u>731</u>

TABLE III.

VARIOUS SPECIAL CREDITS.

	L.E.	M.
Special Low Nile Works (Caisse)	5488	969
Special Low Flood credit	2954	865
Rosetta & Damietta "sudds"	8237	266
Barrage Gardens	1055	470
Total... ..	<u>L.E.17736</u>	<u>570</u>

The figures in these three tables, added together, give the total expenditure upon Irrigation Works for the year.

TABLE IV.

TOTAL EXPENDITURE. 1903.

	L.E.	M.
Ordinary Budget	618783	912
Extraordinary Budget... ..	651756	731
Various special credits.. ..	17736	570
Total... ..	<u>L.E.1288277</u>	<u>213</u>

This is less than the expenditure, under the same heads in 1902, by L.E. 154835.670 Mill.

The foregoing may be subdivided as follows :—

TABLE V.

	L.E.	M.
(a) Regular Budget	201060	579
(b) Corvée Relief (Caisse)... ..	249999	199
(c) Corvée Relief (Finance).. ..	150596	827
(d) Agricultural Roads	12753	236
(e) Special credit for Bridges to replace Ferries	4401	161
Total... ..	<u>L.E.618783</u>	<u>912</u>

(a) The item "Regular Budget" in Table V, is again subdivided thus:—

TABLE VI.

	L.E.	M.
Establishment	80211	844
Contingent charges	20509	597
New Works	19508	981
Maintenance and Repairs	50416	493
Khatatbeh and Atfeh Pumps	450	000
Drainage of Lake Marcotis	10000	000
Land charges	1201	903
Supplementary Reservoir expenditure	15261	761
Etsa Pumping Station... ..	3500	000
Total... ..	<u>L.E.201060</u>	<u>579</u>

The total of this last table is very similar to that of 1902.

(b & c) TABLE V.—CORVÉE RELIEF.

These items call for but few remarks. The distribution of the credit furnished by the Caisse was the same as that of 1902. The credit supplied by the Ministry of Finance was, as usual, distributed according to the necessities of the different provinces and irrigation circles, in which Corvée relief works were executed. The following table shows a subdivision of the Corvée expenditure.

TABLE VII.
CORVÉE ABOLITION.

CORVÉE ABOLITION	Upper Egypt.		Lower Egypt.		Total.	
	L. E.	M.	L. E.	M.	L. E.	M.
Caisse money... .. { 1902	128000	000	121999	370	249999	370
	1903	128000	000	121999	119	249999	119
Regular Budget { 1902	30302	715	120505	473	150808	188
	1903	31357	359	119212	288	150569	827
Total... .. L. E. { 1902	158302	715	242504	843	400807	558
	1903	159357	539	241211	407	400568	946

(d) TABLE V.—AGRICULTURAL ROADS.

The following shows the work done and the expenditure incurred:—

LOCALITY.	Length of roads existing previous to 1903.	Length of new roads constructed in 1903.	Expenditure in 1903.	
	Kilometres.	Kilometres.	L. E.	M.
Upper Egypt and the Fayum... ..	638·	— (land)	3	479
Lower Egypt... ..	1800·40	63·100	12749	747
Totals... ..	2438·40	63·100	12753	226

The apparently excessive expenditure in Lower Egypt, is almost entirely due to the payment of bills for land taken up in the year

previous, but unpaid for, owing to delay in the preparation of the registers.

(c) TABLE V.—BRIDGES TO REPLACE FERRIES.

The total expenditure under the Caisse grant in 1903, was L.E. 4401.161 Mill.

For this money, four bridges were put in hand, two in Upper and two in Lower Egypt. Of these, three were completed and the fourth is under construction.

In Behera Province, an iron bridge was commenced at Khatatbeh to replace an old bridge. L.E. 1000 was expended upon this work in 1902, but it will require a further sum of L.E. 1600 to complete it.

In the Girga Province, 19 timber bridges, on masonry abutments and piers, were built at a cost of L.E. 9420. These bridges were paid for by the landowners themselves, a tax having been imposed (voluntarily) upon the cultivated area of the Province in order to find the funds required.

Out of the 49 bridges voted by the Provincial Girga Councils, 33 have been completed up to the end of 1902.

THE ZIFTA BARRAGE.

This work was completed early in 1903, and inaugurated by His Highness the Khedive in the month of March. The subsidiary canals, taking off right and left of the river above this work, were not sufficiently advanced to enable full advantage to be taken of the Barrage during the summer months. Nevertheless, it played a useful part at a very critical moment. It was regulated upon throughout the summer, and yielded small supplies to the Rayyah Abbas for short intervals during the rotation periods. The great service rendered by this work, however, was during the important time when the flood was first rising. The effect of this first rise is generally very slowly felt, and, as every feddan of land in the upper reaches of the canals is taking water at that moment, the tracts to the north, particularly in northern Gharbiéh, suffer severely by the delay in the arrival of the extra supply. In 1903, water was passed down the Damietta branch, between the 3rd of July and the 14th of August, in sufficient quantity to enable the Rayyah Abbas, by means of the Zifta Barrage, to feed the Bahr Shebin. The water taken from the river upstream of the Delta Barrage, was

thus used for the irrigation of the southern area of the Delta, while the northern tracts derived their supplies from the Zifta weir. The effect was to increase the water supply of the 2nd Circle of Irrigation by 30 per cent during the latter half of July, and throughout August. This permitted the early abandonment of the rotations, and largely assisted the sowing of maize and rice.

“SHARAKI” IN 1903.

The area left unirrigated was a small one. The final returns have not yet been received, but it is not expected that the total will exceed 5000 feddans, all of which is upon islands, or on high foreshores of the river.

CROPS.

The winter crops, both in Upper and Lower Egypt, were generally good.

A very large area was planted with cotton in 1903, and at one time, a record crop appeared probable. There was no shortness of water, but, unfortunately, the same unfavourable climatic conditions were reproduced, which had reduced the yield for several years in succession. These conditions were, a low temperature and fogs during the month of September. In spite of this, the crop was a fairly good one and the latest estimates give the probable out-turn as 6500000 kantars. The price, throughout the season, was exceptionally high.

The maize crop, although affected by the cool weather was a plentiful one.

The cultivation of rice was practically unrestricted, and a very large area was planted with this crop.

The final returns from the sugar Factories in Upper Egypt are not yet to hand, but the sugar-cane crop is reported to have been an average one.

With regard to this last crop, it must not be forgotten that, at present prices and even with a considerable reduction, cotton is far more profitable to the landowner than sugar. Unless then there should be a ruinous fall in the price of cotton, an increase in the area of this crop may be expected in the tracts formerly devoted to sugar-cane, and a corresponding decrease in the area planted with the last-named crop.

THE RISE IN THE VALUE OF LAND IN MIDDLE EGYPT.

Throughout Egypt, there has been a very marked increase in the sale value of all land, but in Middle Egypt, this rise has been especially apparent, in consequence of the increased rental obtainable for land converted from basin to perennial irrigation. This result, although highly satisfactory to the land-owner, is scarcely so much so to the Government, as it has produced a very serious addition to the cost of the conversion works.

The construction of the new canals and drains has necessitated the purchase of considerable areas of land by the Government. These works have been carried out in each province in succession, commencing with Asyut. Thus, when the conversion of one province was completed, work was commenced in that next to it and to the north of it. The Province of Asyut was first taken in hand as being the nearest to the head of the Ibrahimieh Canal, which takes off above the new Asyut Weir. When Asyut was completed, work was started in the Minieh Province, and after Minieh, will come Beni-Suef, and last of all Ghizeh.

The results obtained by the conversion works in Asyut were so satisfactory, as regards the yield of crop, etc., that the landowners in the Province of Minieh anxiously awaited their turn for reaping similar benefits. As soon as it was known that the works were to be commenced, the value of land in Minieh rose throughout the district. As this enhanced rate applied to the land required for the new canals, etc., equally with all other land in the province, the Government found itself in the anomalous position of being obliged to spend considerably more money upon the construction of the very works to which this increased value of the land was due, than would have been the case, did these works produce no benefits to the landowners whatever. In other words, the Government, by spending large sums, increases the productiveness of the land. The proprietors, well aware of this, and equally well aware that land for the necessary works *must* be purchased from them, demand a rate for it, based upon its *prospective* value when these works shall have been completed. Thus, those who will eventually reap the benefits, make their benefactor pay heavily for the privilege of bestowing such benefits upon them! Such a result could scarcely be arrived at in any other country than Egypt.

The only remedy would appear to be the suspension of these works, until an arrangement could be come to with the landowners that they

should give the area of land required at a reasonable rate. Such a suspension is undesirable, as it would defer the realisation of the increased revenue to be obtained from the conversion of the basins, and the people are well aware that it is not likely to be put in force.

The following figures show the cost of the conversion works (per feddan benefitted), as executed, compared with the original estimates:—

I.—*Asyut Province:*

							L.E.	M.	
Original estimate	...	...	...	...	...	...	2	005	per feddan.
Actual cost of works...	...	...	...	...	...	...	3	233	..

II.—*Minieh Province:*

Original estimate	...	...	...	...	...	...	3	153	..
Actual cost of works...	...	...	...	...	...	...	4	556	..

III.—*Beni Suef and Ghizeh Provinces:*

Original estimate	4	000	..
-------------------	-----	-----	-----	-----	-----	-----	---	-----	----

As the work in these last is in progress, the actual cost is not yet known.

It will be observed that, warned by the excess in the cost of construction in No. I, when the estimates for No. II were framed, a considerably increased rate was allowed for. Even this was insufficient, and for No. IV the original rate per feddan (for Asyut) has been *doubled* in the estimates!

Although the price of land is chiefly responsible for the enhanced cost of the works, it is only fair to state that increase is not entirely due to this cause. Owing to the expansion of "Sefi" cultivation in Middle Egypt, labour is now more difficult to obtain, and costs more than was formerly the case. It is now difficult to obtain ordinary labour for less than P.E. 5 per diem, whereas, a year or two ago, it could be easily got for a rate of P.E. 3 per diem. This has naturally produced a corresponding increase in the cost of all classes of works.

In the figures given above, representing the cost of the conversion works, per feddan of land benefitted, the expenditure upon the widening of the Ibrahimia Canal (the main supply channel for Middle Egypt) and the remodelling of the main drain with its pumping stations upon the Nile, has not been included.

If the figures for these works be added to the estimate, then the total cost of conversion, for the 451,000 feddans of basin in the four provinces, will come to L.E. 3,200,000, or some L.E. 7 per feddan of land converted. It will thus be seen that the process of conversion is

a costly one, and it may well be asked whether such an expenditure is warranted.

The results obtained, so far as they go, give a satisfactory reply to such a question.

Up to the end of 1903, some 170,000 feddans of basin land have been converted to perennial irrigation. Assuming the total, final cost, as distributed over the whole area, to be L.E. 7 per feddan, the proportional expenditure, for the area already converted, will be L.E. 1,190,000.

The gain to the landowner has been, that his annual rentals have increased by *at least* L.E. 3 per feddan, and the sale value of his land has risen by *at least*, L.E. 40 per feddan. In other words, for an expenditure of L.E. 1,190,000, the annual rental of 170,000 feddans, has been increased by L.E. 510,000, and the present sale value, by a sum of L.E. 5,100,000.

The gain to the Government will lie in the special rate of P.E. 50 per feddan, which will be levied on the converted lands, in a few years' time. When this rate falls due, the Government, on the area of 170,000 feddans will receive an additional annual revenue amounting to L.E. 85000.

Before these works were undertaken, it was feared that the cultivators of Middle Egypt, having been accustomed to basin irrigation for many centuries, would be slow in adapting themselves to the new conditions. The contrary has been the case. Although short of cattle for agricultural purposes, the readiness with which they have availed themselves of the "Sefi" water, has been very satisfactory.

THE MEX PUMPS.

The cube of water raised, by these pumps, from Lake Mareotis, and passed into the sea at Mex, was, in the winter of 1902-1903, = 346,420,022 metres. This amount is the maximum as yet recorded in any one season's work. It is greater than that lifted in the previous year, by some 11,000,000 cubic metres. The increase is due to the heavy rainfall on the sea-coast in the winter of 1902-1903. The cost of pumping last season fell to a rate of L.E. 32.205 per cubic metre of water lifted, as against L.E. 34.548 for the year before. In spite of this satisfactory result, which is due to good management, the total charge for pumping in 1903 was over L.E. 13000. This is a very heavy charge upon the Irrigation Budget.

NEW WORKS AND REPAIRS IN 1903.

(a) UPPER EGYPT.

PROVINCES OF ASYUT, MINIEH AND BENI SUEF.

The following were the chief items of expenditure :—

Works connected with the } conversion of the basins.	The total cost in 1903, was L.E. 399000.
---	--

For this sum, 733 kilometres of canals and drains were constructed. The works included 386 masonry works and nearly 12 millions of metres cube of earthwork.

THE FAYUM PROVINCE.

Some L.E. 65000 was spent upon remodelling works (canals and drains) connected with the Reservoir. This represents construction of channels for a length of 194 kilometres.

In addition to the above, 14 miscellaneous new masonry works were constructed, and 69 others were repaired, at a cost of nearly L.E. 19000.

7.6 millions of cubic metres of earthwork were executed for a sum of L.E. 100000.

THE ASWAN RESERVOIR.

The final certificate, amounting to £3,320,272, was paid to Messrs. Aird & Co., the contractors, on the 4th of April 1903, in settlement of all accounts.

This is thus divided :—

									£
Cost of the Aswan Dam ...	...	...	...	...	...	...	...	...	2,124,797
.. Asyut Barrage ...	...	...	...	...	...	...	...	...	895,475
								Total ...	<u>£3,320,272</u>

NEW LOCK SOUTH OF ASWAN DAM.

In order to assist navigation between the dam and the town of Aswan, it was found necessary to construct a new lock, (making the fifth in the series) at the Sahel cataract. This work, which was commenced in the winter of 1903 was successfully completed before the flood of that year. The cost was L.E. 49382.

(b) LOWER EGYPT.

The following, were the principal works carried out in 1903.

A sum of L.E.179000 was expended upon new works in connection with irrigation improvements.

The chief heads of expenditure are as follows :—

The Zifta Barrage, the Ismailia Canal head and lock, the Nagail Canal project, the Kasheb Canal project and sundry large regulators.

THE ZIFTA BARRAGE.

The completion of this work has entailed a total expenditure of L.E.420079.

The amount is thus subdivided :—

	L.E.
The Barrage proper... ..	286120
The Rayyah Abbas	99035
The Mansuria canal head	34924
Total	<u>L.E.420079</u>

Of the above, L.E. 89839 was expended in 1903.

THE ISMAILIA CANAL HEAD AND LOCK.

This work was completed in 1903, at a total cost of L.E.62416. Through navigation between the Nile, the Ismailia Canal and the Suez Branch has thus been re-established.

THE NAGAIL CANAL PROJECT.

This is an important scheme for improving flood irrigation in the Province of Menufia. The total expenditure up to date has been some L.E.24000, of which L.E.11000 was expended in 1903.

THE KASHEB CANAL PROJECT.

L.E. 6800 was spent upon remodelling this, the main irrigation channel for 40000 feddans in the Ghizeh Province, on the east bank of the river.

REMODELLING SUNDRY LARGE REGULATORS.

The works put in hand in 1903, were the regulators of Bugaria, Sirsawia, Basium and Qodaba. All these are important works. The expenditure was L.E.5500.

In addition to the above expenditure, a large number of remodelling works, for the improvement of water distribution, were carried out in every province in Lower Egypt.

137 kilometres of new channel were constructed, and some $8\frac{1}{2}$ millions of metres cube of earthwork were executed. This last item represents an expenditure of L.E.179000.

DRAINAGE WORKS IN LOWER EGYPT.

165 kilometres of new drains were constructed in 1903 at a cost of L.E.83552.

This sum includes the cost of several very large masonry works in the shape of drainage syphons, etc.

SPECIAL CREDITS FOR LOW NILE.

The following was the expenditure:—

							LOW NILE		LOW FLOOD	
							L.E.	M.	L.E.	M.
Upper Egypt.	...	...	...	...	...	...	Nil		1577	666
Lower Egypt.	...	...	...	...	...	...	5488	969	1319	903
Central Office	...	...	...	...	...	...	Nil		57	296
Totals...							L.E. 5488 969		2954 865	

RIVER PROTECTION.

Expenditure in Upper Egypt	...	...	...	...	...	...	...	...	L.E.
.. .. Lower Egypt	...	...	...	...	...	...	...	...	3479
Total									27821
									L.E. 31300

BASIN BANK PROTECTION.

On revetment works, a sum of L.E. 5968 was expended in 1903.

THE NILE CORVÉE IN 1903.

The following are the figures :—

LOCALITY							NUMBER OF MEN FOR 100 DAYS	
Upper Egypt	...	...	...	...	...	...	10703	
Lower Egypt...	...	...	...	...	...	...	541	
Total...							11244 men for 100 days	

In both localities, the numbers are very much less than for previous years of similar flood levels.

Mr. Verschoye, the Inspector General of Irrigation for Lower Egypt, is of opinion that the policy of reducing flood watchmen in the Rosetta and Damietta branches of the Nile, and in Ghizeh, has been rather overdone during the past few years. The banks, which have been deprived of their protection of stakes and brushwood, have suffered from wave-action. This will entail a considerable expenditure in repairs.

THE "SUDD" IN THE BAHR-EL-GEHEL.

No work was done, as regards the clearance of this obstruction, during the winter months of 1902-1903. In the latter part of 1903, however, an expedition under Lt. Drury, R.N., attached to the Soudan Service, started with the object of completing this work. Unfortunately, his serious illness at the moment when the work was well advanced prevented its completion.

EXPEDITION TO STUDY THE NILE SOURCES.

In December 1903, two expeditions started for the above purpose.

The one visited Lake Tsana, the source of the Blue Nile, and the other the Lakes Victoria, Albert Edward and Albert, which, with the Sobat and the Bahr-El-Ghazal, constitute the sources of the White Nile. Both missions returned to Egypt in the spring of 1903, and the Reports will be published early in 1904.

NILE GAUGES IN THE SOUDAN.

The following new gauges were erected in 1903 :—

White Nile.

Gondokoro, Mongalla, Taufikia and Ghaba Shambé.

Sobat.

Nasser and Doleib Hilka.

Athara.

Khashem-El-Girba.

LAKE VICTORIA NYANZA GAUGE READINGS.

The rains at the end of 1902, in the neighbourhood of Lake Victoria, were heavier than in 1901. The lake level began to rise in December 1902 and continued to rise until July 1903. It then fell until October, when a fresh rise commenced. According to the latest information, this last rise has been continued. Unless the rains in April and May 1904, should fail, the mean level of the lake will probably be higher in 1904 than has been the case for several years past.

After the almost continuous fall in the mean level of Lake Victoria from 1896 (when regular readings commenced) until 1902, the present year has seen a marked improvement. The following table, compiled by Captain Lyons, Director General of the Survey Department, shows the variation in the mean level of the lake, deduced from the gauge readings, as corrected by him.

Mean lake levels in metres.

SITE	Years.							
	1896	1897	1898	1899	1900	1901	1902	1903
Kisumu	0·928	—	—	0·733	0·391	0·508	0·172	0·731

The readings for 1897 and 1898, for Kisumu, are incomplete.

These figures show that in 1903, in the *seventh* year after the series of six low years, the lake level has risen again.

THE STAFF IN 1903.

The Irrigation Service suffered a loss in the retirement of Major Sir Hanbury Brown, in April of last year. For nearly twenty years he devoted his services to the improvement of irrigation in Egypt, and numerous works testify to his labours in this direction. Among the more important may be mentioned the restoration of the Delta Barrage, with its subsidiary weirs, and the Zifta barrage, the last work being completed shortly before he left the country.

His knowledge and experience of irrigation were exceptional.

On Major Brown's retirement, Mr. A. L. Webb became Inspector General of Irrigation in Upper Egypt and Mr. K. Verschoyle was appointed to the similar post in Lower Egypt. Owing to the completion of the Nile reservoir works, the post of Inspector General of Reservoirs was abolished.

The entire staff worked hard and well and a very successful year bears witness to their labours.

The two Inspectors General of Irrigation, Messrs. Webb and Verschoyle, need no words of praise from me. The good results obtained last year are entirely due to their labours and to those of the Inspectors of the different irrigation circles, who again were ably seconded by a very competent staff.

Part II.—WORKS OTHER THAN IRRIGATION.

I.—THE TOWNS AND BUILDINGS SERVICE.

The following tables show the sums expended by the above service during the year 1903. They are merely an amplification of the details of the total expenditure, as recorded upon pages 4-6 of this Report.

The following was the general distribution :—

	L.E.	M.
(a) Ordinary Budget... ..	213029	258
(b) Special funds granted by Caisse	106076	440
(c) Special funds from other Departments... ..	46414	403
(d) Special works under revenue	11797	696
Total... ..	<u>L.E. 377317</u>	<u>797</u>

This total shows an decrease in expenditure over that of 1902 amounting to L.E. 81840.726 Mill.

The four items in the first table are thus subdivided :—

(a) ORDINARY BUDGET.

	L.E.	M.
(1) General Direction	22150	771
(2) Public Buildings	85565	650
(3) Cairo City	33237	741
(4) Provincial Towns	48385	000
(5) Gas	21301	927
(6) Esbekieh Gardens	2388	169
Total... ..	<u>L.E. 213029</u>	<u>258</u>

The total is more than that for 1902 by L.E. 2114.924 Mill.

I will briefly discuss the different items :—

(1) General Direction.

This calls for no special remark. The sum represents the salaries of the permanent staff and is more than that expended in 1902 by L.E. 444.446 Mill.

(2) *Public Buildings*

The following is the distribution of expenditure:—

	L.E.	M.
Temporary staff	830	000
General charges	4367	650
Materials and plant	910	073
New works	8215	918
Repairs and maintenance	71242	009
Total... ..	L.E. 85565	650

Or, more than the expenditure in the previous year by L.E. 7285.288 Mill.

(3) *Cairo City.*

	L.E.	M.
Temporary staff	736	000
General charges	839	165
Plant and materials	1139	508
Transport of materials... ..	7336	715
New works	3488	554
Repairs and maintenance	19697	799
Total... ..	L.E. 32237	741

(4) *Provincial Towns (Local Commissions.)*

	L.E.	M.
Temporary staff	642	000
General charges	927	889
Materials and plant	5	000
New works	198	736
Repairs and maintenance	46611	375
Total... ..	L.E. 48385	000

The sums in the above table are expended by the local Committees of the provincial towns. These, again, are controlled by a permanent Superior Commission at Cairo, which examines all proposed expenditure, exceeding a certain fixed amount.

(5) *Lighting.*

or Gas.

The total number of gas lamps, in Cairo, at the end of 1902, was 3560; no addition was made to this number in 1903;—6500 more lamps are urgently required in the native quarters of the city. This would entail an expenditure of L.E. 43800.

The fines levied against the Gas Company for defective light have decreased by some 50"/₁₀₀. This is largely due to the better quality of the gas supplied.

The Gas Laboratory, under the Public Works Chemist, was opened in April 1903, and tests to control the illuminating power, the purity and the pressure of the gas supplied by the Company, were commenced on the 4th May of last year.

In accordance with the agreement made, the Gas Company has commenced the installation of "incandescent" burners, at its own expense, to replace the old "flat-flame" burners. Up to date, 500 lamps have been fitted with the new burners. The result is very satisfactory and is a great advance on the old system.

(b) **Electricity.**

7740 metres of new cable were laid in Cairo during 1903. 53600 incandescent lamps of 10 candles power were put up.

The towns of Helwan, Ismailia and Mansura are now lighted by electricity.

Rules and regulations governing all electric installations have been drawn up and will shortly be published.

(c) *The Ezbekieh Gardens.*

In 1903, the receipts were L.E. 1263,382 Mill. while the expenditure was L.E. 2388,169 Mill.

(b) EXPENDITURE UNDER SPECIAL CREDITS GRANTED
BY THE CAISSE DE LA DETTE.

	L.E.	M.
New Egyptological Museum	16399	265
Clearing front of above	938	213
Asphalt paving Cairo streets	14099	483
Repairs to ancient monuments	2892	436
Sundry new buildings	71747	013
<hr/>		
Total... ..	L.E. 106076	440
<hr/> <hr/>		

(c) LIST OF WORKS EXECUTED UNDER SPECIAL FUNDS
PROVIDED BY OTHER DEPARTMENTS.

	L.E.	M.
Delingat Markaz	1796	299
El-Atf Markaz	538	783
Zagazig Mudiriyyeh	652	614
Fleming Police Station	2093	112
Polytechnic School	9999	266
Arabic Museum furniture... ..	2288	333
Agricultural School	252	622
Fayum Tribunal	1423	857
Aswan Tribunal	222	226
Rassel-Tin Palace... ..	11685	390
Rassel-Tin School	3000	000
Tahta Tribunal	640	000
Sundry small buildings	999	033
Achievement Arabic Museum	4682	535
Cairo Girls' School	789	441
Mohamed-Aly School	641	381
Mans-ura School	575	386
Opera House	562	901
Fire-engine room at Girga	534	635
Bulac Printing Office.. ...	468	585
Land for Mans-ura Tribunal	441	000
Repairs to Polytechnic School	367	860
Cemeteries in provinces	360	619
Kasr-el-Nuzha School.. ...	360	000
Fire-engine rooms.. ...	270	264
Transport of Giza Palace roof to Abdeen	200	000
Works under L.E. 200.. ...	259	261
Total... ..	L.E. 46414	403

(d) SPECIAL WORKS COMING UNDER THE HEAD OF "REVENUE."

	L.E.	M.
Cairo City	9087	719
Public Building Revenue	2414	964
Provincial Towns.. ...	293	041
Ezbekieh Gardens.. ...	1	972
Total... ..	L.E. 11797	696

NEW WORKS.

No works of any very special magnitude were under construction in 1903.

21 different buildings were completed in different parts of Egypt, consisting of schools, courts of justice, Police barracks, Government offices, etc.

The total cost of the above has been L.E. 96638, of which L.E. 50114 was expended in 1903.

In addition to the above, 10 other works of the same nature were under construction during the year and are not yet completed. The expenditure for the year was L.E. 21495.

REPAIRS.

A sum of L.E. 45401 was spent upon the repairs, small and great, of 567 Government buildings. Of these charges the heaviest was the roofing of the Ras-el-Tin Palace, upon which a sum of L.E. 14500 was expended in 1903.

THE CAIRO ROADS.

A sum of L.E. 12229 was spent in 1903 upon the upkeep of 490950 square metres of road. This area represents only 17% of the total road surface of Cairo.

In addition to this L.E. 17305 was expended upon the construction of asphalt roads in the native quarters of the city. The experiment has been entirely successful, and is to be continued in 1904, another grant of L.E. 20000 having been accorded for this purpose by the Commissioners of the Public Debt.

TELEPHONES.

Telephonic communication between Cairo and Alexandria was opened in May 1903.

THE CAIRO TRAMWAYS.

The new line to Shubra, a length of 4868 metres, was opened for traffic last year.

The number of people using these means of communication is steadily increasing as the following table shows :—

YEAR	NUMBER OF PASSENGERS FOR THE YEAR.									
1901	14714667
1902	16926050
1903	18957167

NEW BRIDGE ACROSS THE NILE AT CAIRO.

Tenders have been invited for the construction of this bridge. It will cross the Nile at Roda Island, and the length of the roadway will be 535 metres. The tenders will include offers for the construction

of two smaller bridges across the Roda channel. Enquiries regarding specifications, etc., have been received from well known firms in England, France, America, Germany, Belgium and Switzerland. The latest date upon which tenders will be received is the 1st of February 1904.

WATER SUPPLY OF PROVINCIAL TOWNS.

Small water-works exist in 14 towns, not including the more important installation at Tanta. Installations upon a larger scale are projected at Zagazig, Mansura, Menuf, Shebin-el-Kom, Damanhur and Damietta.

THE STAFF IN 1903.

Mr. Perry has, as always, devoted his entire energies to the administration of his Service and has reason to be satisfied with the results of his year's work. He brings forward the names of certain officers of his Staff for special mention, and I cordially endorse his words of praise regarding each one of them.

II.—THE SURVEY DEPARTMENT.

The following Table shows the expenditure for last year :—

										1903	
										L.E.	M.
Permanent staff...	...	...	...	...	...	...	...	...	...	10105	693
General charges	...	...	...	...	...	...	...	...	...	44590	539
Geological survey	...	...	...	...	...	...	...	...	...	3140	682
White and Blue Nile measurements	...	...	...	...	...	...	...	...	...	2445	728
Reproduction of maps	...	...	...	...	...	...	...	...	...	2459	720
										L.E.62742	352

This total is again subdivided thus :—

				1902		1903	
				L.E.	M.	L.E.	M.
Allotment in Public Works Budget				34005	912	32485	352
Allotment given by Finance Ministry							
for the Revenue Survey				20173	000	30257	000
Total				L.E.54178	912	62742	352

The expenditure for 1903 exceeds that for 1902 by L.E.8563.440. The increase being in the allotment made by the Finance Ministry for the Revenue Survey.

Captain Lyons goes into considerable detail regarding the working of his Service and his report is full of interesting matter. I am unable to do more than very briefly allude to the main points of interest in his note.

THE REVENUE SURVEY.

The Provinces of Kaliubia and Dakahlia were completed in the year 1903. The survey of Kena Province was begun. The whole of the Delta has now been surveyed for Revenue purposes.

Captain Lyons makes a good suggestion with reference to the maps deposited with the land registers at the Mudirias. Sales of land are constantly taking place, but, at the Mudirias, there is no accurate system of keeping these maps up to date and thus the map may, in a few months, no longer represent the actual state of the properties, and the mutation register, not being properly kept up, is of no use in revision of the map. He suggests that an annual expenditure of L.E.2,000 be granted for the purpose of keeping these maps up to date by means of a cadastral office in each Mudiria, controlled by the Survey Department. The proposal seems a good one and, if the registration of title deeds is ever introduced, some such arrangement will be necessary.

MAPPING DEPARTMENT.

The sale of maps and publications is steadily increasing. In 1903, a sum of L.E.1721 was thus collected.

In the same year 122817 maps and 30904 publications were issued free of charge to the Government Departments, while 13071 maps and 1648 publications were sold.

TRIANGULATION.

In 1903, the major triangulation of about one-third of Kena and Girga and of Aswan, from Dabba northwards to Esna, was completed.

Base lines were measured at Addedan, Dabba and Khattara and another at Tena for the Girga triangulation. Captain Lyons describes the methods of measurement.

The cost of major triangulation was L.E.2065, for which some 4100 square kilometres were triangulated.

FIELD SURVEY.

752000 feddans were completed in 1903, which is the largest area yet completed in any one year. It is satisfactory to learn that there has been a steady reduction in the cost per feddan during the last two years, both in field and record work.

TOPOGRAPHICAL MAPS.

Owing to want of funds, progress with this most useful work has been but slow. It is much to be hoped that an increased credit may be obtained in the future. Such maps are invaluable to the Irrigation Service, more particularly as regards the study of new projects.

THE GEOLOGICAL SURVEY.

Some of the staff was employed, at my desire, in measuring the discharges of the White and Blue Niles for several months of the year. In 1903, Mr. Barron reviewed the geology of the country between Cairo and Suez, while Mr. Beadnell continued the collection of fossil remains from the upper Eocene beds near the Fayum. Dr. Hume was occupied with the arrangement of the museum collections.

During the year, reports on a portion of the eastern desert and on the Baharia Oasis have been published.

An arrangement has been made with the British Museum authorities, by which the latter will publish in a monograph a full description of the whole of the fossil remains from the Fayum, collected during the last few years. This monograph will include the material existing both in Cairo and London.

METEOROLOGICAL DEPARTMENT.

New stations were equipped in 1903 at the following stations:—

At Mongalla and Ghaba Shambé on the Bahr-el-Gebel;

At Wau on the Bahr-el-Gazal;

At Doleib Hilla and Nasser on the Sobat.

Captain Lyons gives a list of all the stations now existing in Egypt, Abyssinia and the Soudan.

THE CAIRO OBSERVATORY.

The transfer of all the instruments from Abbassia to Helwan took place at the end of the year. In consequence of their pending move, no new work was undertaken in 1903.

THE LABORATORY.

The record of work for the year, under the able direction of Mr. Lucas, was very satisfactory. In the chemical section, 288 analyses were made during the year.

In the physical section, 111 samples of cement and hydraulic lime were tested for tensile strength, etc., while 162 samples of brick and building stores were tested for crushing strength, etc.

The section of weights and scales.

A certain amount of work was done in 1903 for the Government Department.

The gas testing section.

Regular and systematic testing of the Cairo gas was carried out last year. A complete set of the apparatus having been received and erected at the beginning of 1903. This apparatus is exactly similar to that at present used in Paris.

The testing has resulted in a considerable improvement in the illuminating power of the gas supplied in Cairo by the Gas Company.

NILE GAUGES IN THE SOUDAN.

Captain Lyons gives a list of the gauges erected within the last two or three years, on the Upper Nile.

A certain amount has been done in recording the river levels, but much more remains to be done and, of the duties of the future irrigation service in the Soudan, few will be more important than the erection of satisfactory Nile gauges; their safe-guarding, and daily record.

As Captain Lyons remarks—"Many of these gauges have been moved from time to time" and thus, unfortunately, in some cases, a long record has been lost.

Many of those erected are purely temporary, and even the inclined teak gauges, though better than the others, are not entirely satisfactory. All gauges require constant looking after, and the one, of all that I have inspected in the Soudan, which was in the best order, was the gauge erected in front of the American Mission, at Doleib Hilla, on the Sobat; thanks to the care bestowed upon it by the members of the Mission.

Bench-marks are indispensable at every gauge site—otherwise, if the gauge is moved or broken, as has so frequently happened in the past, there is no means of connecting the readings of the new gauge with those of the old one and a valuable record is thus rendered valueless.

GENERAL SCIENTIFIC OBSERVATION.

A certain amount of scientific observation has been carried out in 1903 on a small scale, such as the equipment of a few meteorological stations, the discussion of meteorological data which has been accumulated, the chemical examination of soils and water, and special lines of research at the Observatory. All the above subjects have however been taken up by the ordinary staff of the Department, in the spare moments of their work, but the limit of this time has been reached. Until some financial provision for scientific research can be made, further progress in this direction is impossible.

With an annual allotment of a few thousand pounds, added to Captain Lyons's budget, a great deal could be done, and not only Egypt but the world would be the gainer.

I may mention one very important work, for which, in my opinion, a special credit is urgently required—I mean a system of precise levelling, commencing in Egypt and carried up the Nile Valley into the Soudan.

In a country like Egypt, so entirely dependent upon irrigation and consequently upon a knowledge of the levels of the river and of the country, it is indeed strange that no precise levels of the Nile and of its valley exist. I allude to this, as being one of the most crying wants, but it is only one of many scientific operations which would, if funds were forthcoming, be carried out in Egypt. Captain Lyons has a very highly trained staff, but they are all over-worked and, without special funds, can do but little. With an extra annual credit, say of L.E. 5000, to be devoted purely to work of scientific research, good progress could be made, and there can be no doubt that the result that would be obtained would be well worth this small expenditure.

THE STAFF OF THE SURVEY DEPARTMENT.

Captain Lyons, in his report, mentions many of the members of this staff. I wish to add my testimony to his as to the very excellent services that these gentlemen have rendered. I do not mention any of them by name, it is only because I find it impossible to select any one of them for special mention. One and all of them have done well, and Captain Lyons has every reason to be content with the results of this year's work.

The value of the work executed at the Arsenal in 1903, was less by L.E. 7030 than in the year 1902. This is due, to a certain extent, to a reduction in the work carried out at this establishment for private individuals.

Private work is now discouraged as far as possible, as the Arsenal is not intended to compete with the different trading establishments in Egypt, or elsewhere. Its primary object is to carry out work to meet the requirements of the Government Services. It will, in future, as far as possible, be reserved for the execution of this work alone.

The amount of work executed for private individuals in 1903 was L.E. 241.

The Government steamers were all overhauled and repaired before the flood of 1903. Some of these boats are hardly worth repairing, and it would probably be cheaper to sell them for what they would fetch and apply the proceeds towards the purchase of new boats, with more economically designed engines.

Stores and coal to the value of L.E. 11323 were issued from the Arsenal in 1903. Anis Pasha gives full details of the work turned out by this establishment. His report is a testimony to the excellent work done by the Director of the Arsenal, Mr. H. Curtis.

INSPECTION OF STEAM ENGINES.

The work in 1903 was satisfactory. The inspections were made without any of the old difficulties on the part of the engine proprietors, whether European or native. The licenses are now regularly demanded, and are made out without any unnecessary delay.

367 applications for licenses were received in 1903 as against 290 in 1902.

362 engines were licensed last year. Of these 233 were examined and their boilers tested.

In all, 1903 industrial engines are now working, duly licensed, in Egypt.

The "Contraventions" were few in number: 49 in all. 41 of these were before the native courts and 8 in the Mixed courts. 11 engines were stopped from working by the Native Tribunal and 6 by the Mixed Tribunals.

Three boiler explosions occurred during the year.

QUARRIES.

43 new licences were issued in 1903 and 73 old licences were cancelled. The total number of licenced quarries in Egypt are at present 583. Of these 464 are for ten years and 119 in perpetuity. These last are the old forms of licence and such permits are never now granted.

Anis Pasha has administered his Service in his usual able manner. His name stands so high that any words of praise from me must be more or less superfluous. I have already mentioned the good work done by Mr. Curtis in the Arsenal, and in the other branch of the Technical Service, viz., the control and regulation of steam engines, Mr. Crawley has rendered valuable assistance.

IV.—THE MUSEUM AND ANTIQUITIES DEPARTMENT.

The expenditure for 1903, under the regular budget, was as follows:—

	L.E.	M.
Permanent Staff	7403	272
Temporary Staff	3594	213
General Expenses... ..	3417	344
Total... ..	<u>L.E. 14411</u>	<u>829</u>

Each of these items shows an increased expenditure over that of the previous year, the total excess amounting to L.E. 1227.315 Mill.

To the foregoing is added:—

	L.E.	M.
Receipts from Tourist fund	3951	100
Entries to the Museum..	714	090
Sale of objects.	1050	885
Sale of shakfs..	543	841
Sale of publications.	574	072
Total... ..	<u>L.E. 6833</u>	<u>988</u>

It is satisfactory to note that all the above receipts show an increase over the figures for 1902. The total increase amounts to L.E. 864.076 Mill.

This expenditure is controlled by a permanent Committee, of which the Director General of the Antiquities Service is the President.

As in 1902, a sum of L.E. 4000 was granted by the Caisse de la Dette, for the compilation of the Museum Catalogue and for the repairs to the Karnak Temples.

The expenditure on the latter work was L.E. 2000 in 1903, the balance being devoted to the production of the Catalogue.

Monsieur Maspero's report upon the working of his Service is of extreme interest and will well repay perusal. It contains a record of a good work on the part of himself and his staff. I regret that want of time prevents my doing more than making a very brief allusion to the chief points discussed.

THE ALEXANDRIA MUSEUM.

The Service suffered a loss in 1903, by the death of Monsieur Botti, the curator of the Museum in Alexandria. By the end of the year his successor had not been selected.

THE CAIRO MUSEUM.

The installation of the collection was continued and improved upon in 1903. The lighting in the upper story was altered and much improved, by the introduction of screens and wooden shades to the skylights. The painting of the interior was commenced by Monsieur Maspero's own staff, from funds provided by the Public Works Department. This work will be continued by degrees. A new room has been opened for the collection of the zoology and flora of ancient Egypt. The monument to Mariette Pasha was completed and his statue was placed upon it early in 1904.

THE WORK OF THE SERVICE IN GENERAL.

The electric lighting of the tombs of the kings at Thebes functioned well throughout the season and without accident. The removal of the earth at the Ramseum and at Medinet Abon was proceeded with.

The tomb of Thotmes IV was discovered, but had unfortunately been rifled.

Considerable repairs were executed at the temple of Edfu by Mr. Barsanti. This temple was in a most dangerous state, and consolidation was an urgent necessity. L.E. 1596 was expended in 1903. The west wall was pulled down and rebuilt.

At Karnak. Mr. Legrain re-erected the eleven columns of the great hall which collapsed in 1899, to a height of 6 metres above the floor. The earth in the centre of this temple has been cleared away and the masonry consolidated.

At Philæ. Mr. Maspero says that the work done by the Public Works Department, in 1901 and 1902 (in the way of underpinning and consolidating the foundations) was so good, that in 1902, the total sum spent upon repairs to these temples was only L.E. 10.

At Sakkara, the work, round the pyramid of Ònas, commenced in 1899, was completed.

A great deal of work was done by private Sociétés and individuals in 1903. Monsieur Maspero gives a full and very interesting account of the year's record.

Unfortunately, Monsieur Goubert, of the Institut Français d'Archéologie, was killed at Toumah, by a fall from the rocks.

The receipts of the Service, outside of the Budget, show an increase in 1903.

The following are the details:—

NATURES OF RECEIPTS	1901-1902		1902-1903		Increase.	
	L.E.	M.	L.E.	M.	L.E.	M.
Tourist fund	3796	500	3951	100	154	600
Sale room	926	610	1050	885	124	275
Entries to Museum	625	550	714	090	88	540
Publications and sale of "Shakfs" (pottery	621	252	1117	913	496	660
Totals... .. L.E.	5969	912	6833	988	864	076

THE MUSEUM CATALOGUE.

Four new volumes were published in 1903. Six more are in the press.

THE EXHIBITION AT ST. LOUIS.

A collection of objects, including life-sized models depicting scenes of ancient Egyptians' life, has been despatched to America for exhibition.

V.—AGRICULTURAL RAILWAYS.

The working of the Agricultural Railways was, on the whole, satisfactory in 1903. These lines tend to assist the development of waste lands ; they give the Fellahin better markets for their produce, and they generally act as feeders to the trunk lines.

It must be admitted that they do, in certain local instances, compete more or less with the Government Railways, but in such cases the landowner benefits, as he is a gainer by the competition. The Government Light Railways Commission is at present studying the whole question of readjustment of the classification of goods and rates upon these agricultural lines.

I.—THE EGYPTIAN DELTA LIGHT RAILWAY COMPANY.

The receipts of this Company, to the end of September 1903, show an increase of L.E. 3861 over the previous year. This result is a fairly good one, if it is considered that all markets were closed on account of the cattle plague and that the transport of stone to the Zifta barrage had ceased. This last item alone in 1902, brought in a sum of L.E. 14426.

The working expenses in 1903 increased by 4% over that of 1902. The following is a table of receipts and expenditure

	1902	1903
	L.E.	L.E.
Receipts	125610	129471
Working expenses	77193	80420
Nett receipts	48417	49051
Proportion of working expense to gross receipts	61.46%	62.18%
Passengers carried	3,311,448	3,636,688
Goods carried—tons	463,928	471,529

The above cannot be considered as other than satisfactory returns.

The total length of the Company's lines is now 813 kilometres, of which 12 were constructed in 1903.

37 kilometres more are under construction.

With regard to rolling stock, the Company is still very short both as regards engines and waggons.

II.—CHEMINS DE FER DE LA BASSE-EGYPTE.

The following is the statement of receipts and expenditure:—

	1902	1903
	L.E.	L.E.
Receipts	21857	23092
Working expenses	11150	11381
Nett receipts	10707	11711
Proportion of working expenses to gross receipts	51%	47.6%
Passengers carried	617,443	668,344
Good carried—tons	54,642	55,000

III.—THE FAYUM LIGHT RAILWAYS.

The following are the returns for 1903 as compared with the year previous :—

	1902	1903
	L.E.	L.E.
Receipts	12130	18423
Working expenses	11225	13251
Nett receipts	904	5173
Proportion of working expenses to gross receipts	92.5%	72%
Passengers carried	439,993	478,853
Goods traffic—tons	116,797	75,550

These figures are very fairly satisfactory. The result is largely due to the energy of Mr. Rangabé Bey, the General Manager.

The increase in the working expenses is due to the appointment of a better paid staff.

No extension of lines was made in 1903. The total length is 168 kilometres.

The Government Inspectors reports that the general administration of this Company still shows evidence of slackness.

Mr. Gunn's report upon the working of these lines in 1902 is full of details and will repay study by all interested in the question of light railway progress. These lines now compare very favourably with those existing in many parts of Europe.

VI.—THE ZOOLOGICAL GARDENS, CAIRO.

Under the very able management of Captain Flower, these gardens have prospered well and made great progress during the year just passed.

The following is a summary of the receipts:—

										L.E.	M.
Balance credit from 1902	...	...	...	...	...	...	...	...	...	191	386
Government grants	...	...	...	...	...	...	...	...	...	3144	000
Gate receipts	...	...	...	...	...	...	...	...	...	1217	410
Miscellaneous etc.	...	...	...	...	...	...	...	...	...	61	291
Total...										L.E.4614	087

This is less than the total of the receipts for 1902, by L.E.452.446.

On the other hand, the expenditure in 1903 was less than that for the year previous, being L.E.4504.526, against L.E.4875.147.

Consequently the balance to credit at the end of last year was L.E.109.561.

Considerable improvements were made in the way of housing the collection and several new specimens were added.

On the 6th of October 1903, there were 959 animals and birds in the garden, comprising 222 different species.

Captain Flower, in addition to superintending the Zoological Gardens takes charge of the collection of Nile fish in the aquarium at the Ghezireh grotto.

Twenty-five varieties of fish, belonging to nine different families, are now to be found in the tanks. The collection is well arranged, and worth a visit. Unfortunately, it does not seem to attract the ordinary visitor, beautiful though the gardens, in which the aquarium is located, are.

The expenditure upon the tanks and fish in 1903 was only L.E.74.191.

VII.—THE CENTRAL OFFICE.

The following is a detail of the expenditure :—

	L.E.	M.
Permanent staff	21944	468
Temporary staff	1968	082
General charges	3183	758
Material and furniture... ..	114	805
New works ⁽¹⁾	17889	728
Total	<u>L.E.48100</u>	<u>841</u>

(¹) This item is thus made up :—

	L.E.	M.
Opera house subvention and staff	6746	960
Maintenance of above	1276	—
Zoological Gardens... ..	1500	—
Arab monuments	999	998
Aswan new lock	1796	750
Inauguration Aswan Reservoir	5448	020
Sundry charges	120	—
Total	<u>L.E.17889</u>	<u>728</u>

or more than that of 1902, by L.E.7287,639.

This increase is chiefly due to the expenditure upon the inauguration of the Aswan Reservoir, and that upon the new lock at Aswan.

THE STAFF IN 1903.

Monsieur Boinet Bey, the Secretary General, has given me the most efficient assistance throughout the year. His services have been of the greatest value.

As regards the services rendered by Mr. Farid Bey Babazogli, the Chef du Service Administratif, I have nothing to add to the remarks I have made in previous reports. They have been quite exceptional.

The entire staff has worked well.

W. E. GARSTIN,

*Under Secretary of State
for Public Works.*

Cairo, the 25th June, 1904.

ADMINISTRATION REPORT
OF THE
IRRIGATION DEPARTMENT IN UPPER EGYPT
For 1903

BY
A. L. WEBB,
INSPECTOR GENERAL OF IRRIGATION UPPER EGYPT.

ADMINISTRATION REPORT OF THE IRRIGATION DEPARTMENT IN UPPER EGYPT FOR 1903.

Part I.—IRRIGATION AND DRAINAGE.

SECTION I.—THE NILE.

In previous annual reports it has been customary to describe the state of the river during the various seasons by comparing the levels of the year with those of the preceding one, or of some special year of high or low levels. In past years the Aswan gauge has been taken as the basis of these comparisons, but owing to the completion of the Aswan Dam, and the filling of the Reservoir during the last months of 1902 and the three first months of 1903, and the utilization of its stored water in April, May and June of 1903, it can no longer be so accepted, for it is considerably affected by the operations of working the sluices of the Dam. Firstly, while filling is being carried out, the gauge which is situated near the Aswan town at a distance of five kilometres downstream of the Dam, records lower readings than it would if no dam existed, as a portion of the discharge of the river is daily retained in the reservoir: secondly, when the reservoir is full, and it becomes necessary to supplement the summer supply of the river for Middle and Lower Egypt, a portion of the stored water is daily discharged, and higher gauge readings consequently result.

Except, therefore, for the flood months of July, August, September and October, during which the sluices of the Dam are fully opened, and the supply passes freely, the Aswan gauge must be rejected as a basis of comparison with former years.

It is, consequently, necessary to select for the winter and summer months a gauge, which is unaffected by the working of the Aswan Dam, and Halfa, being a reliable masonry gauge, can be chosen. In order to preserve a comparison with the past, the readings of the Halfa gauge will be taken for the last year of the old system (1902), before the Dam was first brought into use in 1903.

*Halfa Gauge. (Winter and Summer supply).—*The following statement gives the reading of the Halfa gauge on the 1st and 15th of each month of 1902 and 1903, as well as those of November and December 1901, omitting the flood months of July, August, September and October for the reasons given above. Vide Plate I.

YEAR	Novemb		Decemb.		January		February		March		April		May		June	
	1st	15th	1st	15th	1st	15th	1st	15th	1st	15th	1st	15th	1st	15th	1st	15th
1901	4.33	3.75	3.23	2.99												
1902					2.70	2.29	1.91	1.73	1.60	1.39	1.28	1.39	1.22	1.23	1.13	1.30
1902	4.60	3.92	3.37	3.10												
1903					2.80	2.58	2.20	1.84	1.60	1.42	1.22	1.10	1.00	1.00	0.98	1.65
1903	5.85	4.68	3.80	3.40												

From the above it will be seen that the levels during the winter 1902-1903 were higher than those of 1901-1902, but during April, May and first half of June, they were even worse in 1903 than the exceptionally low levels of 1902 for the corresponding months, and the supply for the summer crops would have been very poor, but for the extra amount given by the Aswan Reservoir. The early rise in June was, moreover, of great assistance.

The minimum levels registered at Halfa were :—

In 1902 1.13 from 30th May to 2nd June.

In 1903 0.95 on 21st May.

The levels in November and December 1903, as shown above, are somewhat higher than those of 1902 for the same months, and consequently, the prospects for 1904 are better than for the year under review.

*Aswan Gauge. (Flood Months). Vide Plate II.—*At the beginning of July the Reservoir was empty and the river passing freely through the sluices of the Dam : on the 7th July the level was almost that of the average of 20 years (1873-1892). During July the rise was fairly normal, but the levels attained were below the average: during the first week of August the rise was slow, and at the end of that week there was a break till the 12th, which rendered the rise late and slow : after that date the rise was fairly rapid and continuous till the maximum of 16 pics 6 kirats (R.L. 92.93) was

reached on 27th August; from 25th to 28th August the levels were just above the mean of 20 years, but from 29th August they fell again, and remained so till the end of the year, except for a few days in October, and first half of November, when an unexpected rise occurred for 2 or 3 days.

For 41 days, i.e. from August 23rd to October 2nd, a level of 15 pies, and above, was maintained: this satisfactory level made the flood of 1903 a fairly average one, and similar to those of 1897, 1900 and 1901, as is shewn by the following table:—

ASWAN GAUGE READINGS	1897	1900	1901	1903
	p.k.	p.k.	p.k.	p.k.
Maximum	16·0	16·5	16·1	16·6
Mean of 40 days August 16th to September 24th	15·6	15·7	15·3	15·5

Summing up the observations at Halfa and Aswan, the following results are obtained regarding the state of the river during 1903, viz :

- (a) During the winter months the levels were low.
- (b) During the summer months the levels were extremely low.
- (c) The early rise in June was very beneficial.
- (d) The flood was late in its early stages, but afterwards improved, and finally resulted in becoming an average one.

At Asyut.—The following statement shows the average of the daily gauge readings at the head of the Ibrahimiyah Canal during the summer months of 1903 and in typical years.

HEAD OF IBRAHIMIYAH CANAL.

YEAR.	AVERAGE GAUGE-READINGS AT ASYUT DURING				Nature of Summer Levels.
	April.	May.	June.	July.	
1899...	46·50	45·91	45·47	46·52	High.
1885...	45·52	45·13	44·87	47·25	Fair.
1901...	45·03	45·15	45·42	46·69	Low.
1889...	44·99	44·75	44·57	45·60	Very Low.
1892...	45·24	44·77	44·58	45·55	" "
1900...	44·89	44·88	45·17	46·19	" "
1902...	46·24	46·26	46·15	46·46	Regulation first made on the Asyut Barrage.
1903...	46·70	46·53	46·60	47·55	Aswan Reservoir first used for giving supplementary supply.

Owing to the regulation on the Asyut Barrage and the supplementary supply in the river from the Aswan Reservoir for the first time, the levels at the head of the Ibrahimiyah Canal were the highest on record, notwithstanding the very low state of the river at Halfa during the summer months.

The real rise of the flood reached Asyut on 25th July, and steadily but slowly continued until the 3rd August, when there was a break for a few days: on the 7th it again commenced to rise till the 11th August, when another break occurred: from the 15th August the rise was rapid, and continuous, until the 28th when a gauge of 51·64 was attained; from the 29th August the gauge fluctuated until the 16th September, when the maximum of 51·67 was reached; after that date the levels were well maintained until the end of the flood.

At Sohag.—In last year's report the level of the Sohag gauge was introduced for the purposes of comparison with previous years: as this gauge is now affected by the supplementary supply from the Aswan Reservoir, it should be omitted in future.

Gauges at the first Cataract.—The following statement gives the highest and lowest levels recorded above and below the first Cataract for the past seven years:—

YEAR.	MINIMUM GAUGE READINGS.			MAXIMUM GAUGE READINGS.		
	Phila.	Aswan.	Difference.	Phila.	Aswan.	Difference.
	R. L.	R. L.	Metres	R. L.	R. L.	Metres
1897	90·56	85·62	4·94	97·95	92·80	5·15
1898	89·74	84·74	5·00	99·05	93·63	5·42
1899	90·70	85·15	5·55	97·00	91·67	5·33
1900	91·20	84·07	7·13	98·54	92·91	5·63
1901	90·90	84·54	6·36	99·07	92·82	6·25
1902	91·10	84·43	6·67	97·70	91·72	5·98
1903	92·90	84·35	8·55	98·94	92·75	6·19

The Philæ gauge is on the Philæ island one kilometre upstream of the Dam: the Aswan gauge is on Elephantine island, opposite Aswan town, six kilometres downstream of the Dam. Between the Dam and the Aswan gauge there is a considerable fall over the rapids in the different channels of the river, so that the above figures do not give the actual head on the Dam and are somewhat misleading.

Comparing the different years, it would seem that the actual afflux due to the Dam is about 50 centimetres, which is very satisfactory:

owing to regulation on the sluices of the western channel to assist navigation a comparison with former years is, however, not reliable.

River gauge South of Halfa.—These are now recorded by the Director General of Surveys, who has a complete register of all gauges.

SECTION II.—SUMMER IRRIGATION.

The volumes entering and utilized in the Ibrahimiyah Canal during the summer months of the last five years, and the very low years of 1889 and 1892, are given below in cubic metres per second, together with the dates of the complete closure of Deirut Escape:—

YEAR.	APRIL.		MAY.		JUNE.		Date of complete closure of the Deirut Escape.
	Discharge at head.	Discharge utilized.	Discharge at head.	Discharge utilized.	Discharge at head.	Discharge utilized.	
1889	37·1	37·1	32·5	32·5	26·4	26·4	15th February.
1892	48·4	48·4	36·1	36·1	29·5	29·5	9th March.
1899	145·1	96·5	123·5	118·4	83·0	83·0	1st June.
1900	46·9	46·9	41·9	41·9	49·4	46·1	14th February.
1901	48·4	48·4	46·6	41·8	64·6	64·6	Re-opened 20th May.
			55·5	55·5	64·6	64·4	Re-closed 16th June.
							18th February.
1902	82·8	54·6	101·5	64·7	106·7	66·2	16th to 19th January
							20th Jan. to 2nd Feb.
							6th Feb. to 24th Feb.
							6th Mar. to 25th Mar.
							27th June to 5th July
1903	117·7	117·7	104·8	104·8	124·3	124·3	15th July to 10th Oct.
							6th February.

N.B.—In 1900 and 1902 regulation was made at Deirut for the benefit of Lower Egypt, as the discharge entering the head of the Ibrahimiyah Canal was in excess of the proportionate share for Middle Egypt.

The discharge utilized varies with the discharge available, and after the complete closure of the Deirut escape, the whole of the available discharge is utilized.

From the above it will be seen that the supply available, and utilized, was excellent in April and May, and in June far greater than obtained in any previous year, in spite of the low state of the river at Halfa; the increased supply is due to the benefit derived from the Aswan Reservoir. The result was to ease the rotations in the old perennial area, to give sefi water to the converted Asynt basins, and half the Minia basins, and also to the whole of the Fayum Province, which had only been partially supplied in previous years.

Supplementary supply from the Aswan Reservoir.—In 1900 and 1902 regulation was made at Deirut for the benefit of Lower Egypt, and part of the Ibrahimiya discharge was escaped there, as the supply at the head of the canal was in excess of the proportionate share of the river for Middle Egypt.

In 1901 there was no regulation at Deirut, and the discharges of that year were taken as a basis for the requirements for Middle Egypt. The discharges of 1901 for April, May, June and the first half of July, gave a mean of 6 millions, and this supply was insufficient. To this was added $\frac{1}{2}$ million to make good the deficiency, another million for easement of rotations on the old perennial area, and 2 more millions for extra sefi area expected in the converted basins and the Fayum, the whole making a total of $9\frac{1}{2}$ millions.

The additional supply to be received from the Aswan Reservoir to give this $9\frac{1}{2}$ millions was thus arranged:—

Required at Asyut	{	From 1st April to 15th May...	3 millions	} To be let go seven days earlier at Aswan
		.. 16th May to 30th June	4 ..	
		.. 1st July to 14th July...	5 ..	

The actual discharge at the head of the Ibrahimiya Canal, which was utilized, gave $9\frac{1}{2}$ millions during April, May and June: during the first half of July it was in excess of that amount, as it was found possible to let the reservoir be discharged earlier than anticipated, owing to the early rise at Halfa: to obtain a discharge of $9\frac{1}{2}$ millions a level of 46.50 to 46.55 is required at the head of the Ibrahimiya.

Owing to the low levels of the river, it was found necessary to supplement the river discharge by 1 million a day from 10th to 24th March for the Ibrahimiya supply; this, however, should have been avoided, as water was still leaking through the Delta Barrages.

Fayum supply.—Up to the end of 1902 applications for sakihs to replace shadcofs, and engines and pumps to replace groups of sakihs, had been generally refused throughout the 4th Circle, but with the advent of the Aswan Reservoir they were granted during 1903. There were numerous applications for the areas on the sahel of the Yusufi from Deirut to Lahun, and with the object of giving an increased supply for this extension of sefi area and for the expected increase in the Fayum, regulation on the Yusufi head was made as follows:—

During first half of April 30 cents higher than levels of 1902.

During second half of April 20 cents higher than levels of 1902.

During first half of May 20 cents higher than levels of 1902.

During second half of May 10 cents higher than levels of 1902.

The old area of the Fayum Province was taken as 330,000 feddans, and it was assumed that one third or 100,000 feddans, requiring 3 millions per day, would be put under sefi crops: the area reported is, however, only 69,000 feddans, being an increase of 22,000 feddans over the area of the previous year.

During April, and first half of May, the mean discharge of the two canals (Yusufi and Hassan Wassif) entering the Fayoum was 3,700,000 cubic metres per day, of which a considerable proportion was used for the irrigation of the berseem crop, which was late. From the second half of May to July, the discharge in the two canals gave just under 3,000,000 cubic metres per day, which is sufficient for the anticipated area of 100,000 feddans; the whole supply, however, seems to have been utilized somewhere, as the levels of Lake Qarun were not affected, as would have been the case had water been running to waste. The only conclusion that can be arrived at is, that the return of the sefi area as 69,000 is incorrect.

Rotations.—Rotations commenced on the Ibrahimiyah Canal and branches between 15th and 20th April. There were two classes of rotations on the main regulators of the Ibrahimiyah, viz:—

	CLASS I.	CLASS II.
Minia Regulator	7 days	8 days
Matai Regulator	6 days	7 days
Magaga Regulator	6 days	7 days
Above Sharahnah... ..	10 days	11 days
Below Sharahnah... ..	12 days	13 days

On the Saheliyah Canal.—

	CLASS I.	CLASS II.
Above Raramun	9 days	10 days
Below	10 days	11 days

The more severe third class of previous years was rendered unnecessary by the supplementary supply from the Aswan Reservoir. During the summer of 1903 rotations were introduced on the canals of the Asyut converted basins. At first three groups were tried, but this was not satisfactory, and subsequently two groups or sections on each of the main canals worked successfully; they were as follows:—

On Deirutiya Canal.—The first Section was everything north of the Dermuwas Regulator including the Ashmumin Canal and its branches. The second Section was from the head of the Deirutiya to Dermuwas Regulator, with Ganabiyahs East and West of that regulator.

On Badraman Canal.—The first Section was Badraman Canal below Beni Haram regulator, and all its branches in this length, Arus Canal and branches, and Nasriyah Canal north of Regulator in Tanuf Saliba with branches. The second Section was Badraman Canal from head to Beni Haram Regulator and branches (except Arus Canal).

Melwaniyah Canal and Nasriyah Canal from head to Tanuf Salibah bridges, with Ganabiyahs east and west at those bridges.

The classes of Rotations were :—

					CLASS I	CLASS II.
On Deirutiyah Canal	1st Section	...	...	...	10 days	10 days
" " "	2nd "	...	...	...	8 "	10 "
On Badraman Canal	1st "	...	...	...	8 "	10 "
" " "	2nd "	...	...	...	10 "	10 "

In the Fayum Province rotations were worked on the heads of the two main canals at Lahun, the Yusufi and Hassan Wassef, during June in alternate periods of 10 days each : this system seems to have been more satisfactory than the old one, and is certainly far more simple.

In the northern Minia converted basins where sefi water was given for the first time, rotations were introduced from 21st April till 21st July. The canals were divided into three sections, each section taking water 6 days out of 18. The rotations worked successfully, but as the system of canals will not be complete until the Southern Minia basins are converted, it is too early to give any definite opinion on their final success.

The Cotton Crop.—The areas under cotton irrigated by the Ibrahimiyah Canal and its branches in the past six years are as follows :—

1898...	...	...	...	...	...	...	...	100,005 feddans
1899...	...	...	...	...	...	...	...	90,887 "
1900...	...	...	...	...	...	...	...	92,842 "
1901...	...	...	...	...	...	...	...	105,750 "
1902...	...	...	...	...	...	...	...	95,356 "
1903...	...	...	...	...	...	...	...	153,000 "

showing an increase of nearly 60,000 feddans over the previous year, and nearly 50,000 feddans over the previous record year of 1904.

The following statement, kindly furnished by Mr. Wakeham, Agent of Messrs. Carver Bros in Upper Egypt, shows the out turn of the ginning factories in the different provinces during the past six seasons.

SEASON.	Asyut.	Minia.	Beni Suef.	Fayum.	TOTAL.	Average price per kantar.
	kantars	kantars.	kantars	kantars	kantars	P. T.
1898-1899	Nil.	74,000	143,000	137,000	354,000	156
1899-1900	Nil.	105,000	139,000	170,000	414,000	205
1900-1901	Nil.	104,000	131,000	130,000	365,000	275
1901-1902	Nil.	128,000	174,000	130,000	432,000	205
1902-1903	Nil.	161,650	164,500	145,000	471,150	275
1903-1904		295,000	235,000	235,000	765,000	325

The out turn of 1903-1904 shows an increase of 62 per cent over that of the previous year, whereas the increase in area under cotton cultivation is 60 per cent. It is generally allowed that the crop of 1903 was not as good as that of 1902 : it may, therefore, be presumed that the areas under cultivation are incorrectly given, and should be greater in 1903 than shown above.

The following statement gives the area of feddans of cotton in the different provinces, irrigated by the Ibrahimiyah Canal and its branches, including the Bahr Yusef, during the past six years.

YEAR.	Asyut.	Minia.	Beni Suef.	Fayum.	TOTAL.
1898 ...	2,635	19,580	26,253	57,537	100,005
1899 ...	1,874	20,576	22,277	46,160	90,887
1900 ...	2,753	27,912	26,086	36,091	92,842
1901 ...	3,361	26,599	28,177	47,643	105,780
1902 ...	1,824	26,085	27,103	40,341	95,356
1903 ...	8,349	54,527	31,872	58,251	153,002

There is a large increase in each Province : Minia is greatest with 28,000, Fayum next with 18,000, Asyut 6,500 and Beni Suef last with 4,800 feddans.

Besides the above areas there were 501 feddans irrigated from the Nile direct, and from wells in the Minia Province, and 6,297 feddans, in Beni Suef Province in the basins from wells and Nile direct. The increase in Minia and Asyut is due to the conversion of some of the basins, and to the decrease in the area of Qedi grown in the basins, as well as to the decreased area of sugar cane : in the Fayum, the increase is due to the better supply given in the summer months.

Sugar cane.—The following statement gives the quantities of cane crushed in the chief factories in Upper Egypt and the out turn of No. 1 Sugar during the past six seasons :—

SEASON.	DAIRA SANIYEH			DAIRA SULTAN PASHA.			SOUTH GIZAFAH DES SOLANGES DE LA HAUTE-EGYPTE			EGYPTIAN SUGAR AND LAND COMPANY		
	Cane crushed	Outturn No. 1 Sugar	Percentage	Cane crushed	Outturn No. 1 Sugar	Percentage	Cane crushed	Outturn No. 1 Sugar	Percentage	Cane crushed	Outturn No. 1 Sugar	Percentage
	Kantars	Kantars		Kantars	Kantars		Kantars	Kantars		Kantars	Kantars	
1898-1899.	12,680,941	1,253,525	9.2	47,0822	4,6885	9.1	6,250,320	604,002	9.1	540,555	49,128	9.8
1899-1900.	14,515,565	1,503,953	9.4	46,927	42,050	6.2	5,578,871	575,100	9.1	501,400	46,608	9.2
1900-1901.	11,850,185	1,191,471	9.98	52,106	49,409	9.04	6,908,772	682,587	9.88	850,500	81,510	9.06
1901-1902.	12,442,452	1,245,843	10.01	49,465	49,230	9.75	7,555,548	642,813	8.49	—	—	—
1902-1903.	11,115,191	1,028,107	9.2	56,593	46,892	8.28	8,001,787	705,785	8.80	—	—	—
1903-1904.	—	—	—	58,828	37,000	6.4	11,570,118	1,500,055	1.31	—	—	—

The total number of kantars crushed and the total outturn of No. 1 Sugar for each of the six years included in the statement are as follows:—

SEASON.	Cane crushed	Outturn of No. 1 Sugar.
1898-1899	20,957,441	1,950,750
1899-1900	21,969,136	2,080,637
1900-1901	20,134,223	1,975,337
1901-1902	20,506,465	1,928,886
1902-1903	19,719,209	1,870,582
1903-1904	15,044,276	1,186,386

The following statement gives the area under sugar cane irrigated from the Ibrahimiyah Canal in the different provinces, during the last six years, and the area grown South of Asyut irrigated by pumps and wells:—

YEAR.	Asyut.	Minia.	Beni-Suef.	Fayum.	Total	South of Asyut.	Grand Total.
1898 ...	9,883	35,232	5,383	854	51,352	—	—
1899 ...	9,473	33,829	7,082	677	51,061	—	—
1900 ...	8,052	22,139	5,670	458	36,319	17,440	53,759
1901 ...	12,780	28,413	6,282	618	48,093	14,522	62,615
1902 ...	10,519	28,904	5,725	799	45,947	15,091	61,038
1903 ...	8,646	25,430	4,072	669	38,817	14,853	53,670

The figures of 1903 in Middle Egypt are less than those of 1902, owing to the substitution of cotton cultivation for that of sugarcane.

Sorghum or Summer Durah.—The following statement gives the areas of summer durah or “Qedi” grown in the basins of the different provinces during the last six years:—

YEAR.	AREAS IN FEDDANS IN THE DIFFERENT PROVINCES.							Total Area.
	Aswan.	Kena.	Girga.	Asyut South.	Asyut North.	Minia.	Beni-Suef.	
1899 ...	3,195	23,334	29,984	10,150	8,572	5,495	7,072	87,766
1900 ...	2,972	24,258	39,261	12,389	7,701	3,890	6,076	96,547
1901 ...	2,482	21,526	41,433	10,334	7,850	4,734	8,734	97,093
1902 ...	3,381	19,510	38,372	12,555	9,232	5,072	5,384	93,506
1903 ...	3,221	18,863	40,031	10,341	810	~ 905	4,239	78,413

~ This does not include the six northern basins of Minia, which were under conversion, and no accurate record kept; next year this item will disappear altogether from the returns.

Maize and Winter Crops.—The area of Nabari durah sown in the southern provinces is estimated at 134,000 feddans against 165,000 feddans in the previous years. The decrease is due to the better levels in 1903; in low floods the areas sown in the higher portions of the basins are considerably more than in years of good or average flood.

Duty of Water.—The total area of summer crops irrigated by the Ibrahimiya Canal, according to figures furnished by the Chief Engineers, is shown in the following statement:—

PROVINCE	Cotton.	sugar Cane	Son Durah.	Other Crops	Total.
Asyut	8,349	8,646	7,263	—	24,258
Minia	54,527	25,430	11,701	1,197	92,855
Beni Suef	31,872	4,072	2,283	2,169	40,396
Fayum	58,254	669	—	10,055	68,978
Totals... ..	153,002	38,817	21,247	13,421	226,487

In the above figures for Minia are included 2647 feddans irrigated from the Bahr Yusuf, which must be deducted when dealing with the Ibrahimiya canal discharges: thus, the Minia area should be taken as 90,208 feddans, and similarly in Beni Suef an area of 10,485 feddans was irrigated from the Bahr Yusuf, therefore the Ibrahimiya area in Beni Suef will be 29,911 feddans.

The mean and minimum discharges recorded during the year in the Ibrahimiya and Yusufi Canals are as follows:—

CANAL.	Site	Mean discharge April to June c. metres per day.	Lowest recorded discharge c. metres per day.
1. Ibrahimiya	Above Deirut ...	8,625,929	7,128,000
2. "	Below Deirut... ..	5,332,978	4,001,184
3. "	" Maghagha ...	1,036,429	793,152
4. Bahr Yusuf & Hassan Wassif... ..	" Lahun ...	3,289,124	2,354,400
5. Ibrahimiya	From Deirut to Ma- gaga	4,296,549	3,208,032

N.B. The discharges for No. 5 are obtained by deducting No. 3 from No. 2.

Taking the areas in the different Provinces we obtain the duty of water in each group as follows, in cubic metres per day per feddan irrigated.

PROVINCE.	Total area of Crops.	Duty on mean discharge.	Duty on minimum recorded discharge
1. Asyut, Minia, Beni Suef & Fayum	226·487	38·08	31·40
2. Minia & Beni Suef together irrigated from Ibrahimiya only	120·119	44·39	33·31
3. Beni Suef irrigated from Ibrahimiya only	29·911	34·65	26·51
4. Fayum	68·978	47·68	34·13
5. Minia irrigated from Ibrahimiya only ...	90·208	35·23	23·16

These duties are remarkably low, and can only be accounted for by the excellent supply enjoyed by Middle Egypt owing to the Aswan Reservoir and the Asyut Barrage. The mean and minimum discharges have no doubt been abnormally increased by the rapid discharge of the Reservoir in June, at the same time the duties show that the supply was more than sufficient; it should, however, be remembered that owing to a late season the berseem crop, which is not included in the sefi area, had to be irrigated up till the middle of May, and at the end of June the surplus water was used for irrigating Sharaki lands for the flood durah crop.

SECTION III.—FLOOD IRRIGATION.

General Character of Flood.—As already described, the flood was late in its early stages, but afterwards developed into one of average levels, and no real difficulties were experienced in carrying out the flood irrigation.

Filling the basins.—In the Aswan isolated basins water commenced to enter the canals on 14th August, and the basins reached their maximum levels between 27th and 29th August: all the water was utilized for the irrigation of the durah crop, so that none was discharged on to the river. The Sharaki area is about 1,000 feddans.

In the Ramadi system water entered the basins between 10th and 17th August, and T.R. levels were reached between 19th September and 7th October.

The level of the river at the head of the main canal was 0·81 metre below the T.R. level of the southern basin El-Ramadi, but only about 130 feddans were left sharaki.

A rotation was established between the basins and the Matana Teftish to give water to the sugar cane: it seems to have given satisfaction.

In the Asfun system, water entered the basins between 14th and 18th August, and T.R. levels were reached between 14th September and 14th October.

A rotation was also made in this system between the basins and the Daira Sanieh Teftish.

In the Fadiliyah system, water entered the basins between 15th and 18th August, and T.R. levels were reached between 30th September and 18th October.

In the Sahil Farshut system, water entered the basins between the 16th and 18th August, and T.R. levels were reached between 13th September and 10th October.

In the Kilabiyah system, water was admitted to the basins between 10th and 15th August, and T.R. levels were reached between 4th and 8th October.

In the Bayadia system, water entered the basins between 14th and 16th August, and T.R. levels were reached between 30th September and 12th October.

In the Shanhuriyah system, water was admitted to the basins between 11th and 17th August, and T.R. levels were reached between 27th September and 25th October.

In the Ghilazi system, water entered the basins between 15th and 18th August, and T.R. levels were reached between 21st September and 19th October: this system was fed through the Kena Khor for the first time.

In the Girga Directorate the main canals were opened between 10th and 15th August, but, owing to the low levels at the commencement of the flood, water did not enter the basins of the following systems until the dates shewn, viz :—

Khiyam System between	...	...	15th and 17th	August
Aklunin ..	..	...	12th .. 16th	..
South Solag ..	...	...	12th .. 23rd	..
North ..	..	...	13th .. 24th	..
Khizindariyah ..	...	...	13th .. 22nd	..

Wherever possible, the tail escapes of the different systems were opened so that water might enter into the basins direct from the

river: in no case, however, did this last more than a few days: no water was taken from the Samhud basin to feed the southern basins of south Sohag system, nor was any drawn from Hod Hannad for the Khiyam system.

Owing to the long period at which the Aswan gauge stood above 15 pies no difficulty was experienced in bringing all basins to their T.R. levels early in October.

In the Asyut Barrage Directorate water was allowed to flow freely from the Sohagiyah through the Gebel Asyut Regulator, which it reached on 14th August. Regulation was made on Gebel Asyut Bridge from September 20th to bring the southern basins to T.R. levels.

The basins in the Asyut-Delgawi system were filled without difficulty from the Gebel Asyut Regulator, assisted by the Muharak and Qusiyah feeders from the Ibrahimiyah Canal, which were open from 23rd August to 26th September, and by the Delgawi feeder head which was opened whenever the 4th Circle could spare water.

The level maintained in the Yusufi down-stream of the Deirut Head was R.L. 46.40, which proved perfectly satisfactory for the sahils on the west of the Yusufi as far as Badraman.

On the east of the Ibrahimiyah Canal from Asyut to Deirut all basins were easily filled with the exception of the Waladiyah basin, which was only brought to a sufficient level to prevent Sharaki by the flush in the river, due to the discharge of the Abutig escape.

In the Abnub system, water entered the basins between 12th and 17th August, and the whole system was filled by 12th September, with the exception of Hods Gorailb, Wasta, and Maasara which were brought to T.R. levels from the Maghar El-Matmar Canal between 13th and 15th October.

In the 4th Circle Mr. Clowes describes the filling of the basins as follows:—

“The Bahr Yusuf was maintained at a level of 46.40 below Deirut from 23rd August to 2nd October, when it was lowered to allow of taklif from Hod Delgawi.

“Hod Tuna and its hoshah and Hod Beni Khaled in the Asyut Province, were late in receiving water, due to the tardiness of the cultivators in removing their durah crop. These Hods received their supply from the Yusufi, and were filled easily, Hod Beni Khaled being kept low purposely till the end of September to pass part of the Yusufi supply through the Hod.

“The flooding of the west of Yusufi basins, Minia Province, began from 12th August for the Northern system, and 15th August for the Southern system.

“Upstream Nezlet El Abid Regulator reached T.R. level of 40.50 on 24th August, and up to this date a downstream level of 38.50 had been kept for requirements northwards. During the last week of August the downstream gauge at Nezlet El Abid fluctuated, but throughout September a mean level of 38.90 was maintained, which is about 30 cents higher than in 1962, owing to a higher level of about 30 cents being run at Deirut in the Yusufi.

“Saqlah upstream level rose steadily, and reached its T.R. level of 34.50 on 1st October, an average level of 31.30 being maintained downstream for the benefit of the Lahun gauge till the middle of September; in the second half of September the level fell to a mean of 31.00. The Southern system of the West of the Yusufi Minia basins began takfifing at the end of September, which caused the downstream level at Saqla to rise, and also gave the upstream level required, which could not be obtained at an earlier date, as a greater head than 3 metres is not permitted on this Regulator.

“Due to the takfifing of West Yusufi basins, Minia Province, it was found possible to regulate on Mazurah on 30th September, and T. R. level was obtained above that Regulator on 3rd October. The downstream level was kept at a mean of 28.30 through August and September, and up to 11th October, which was sufficiently low to let the Mazurah drain work efficiently.

“In the Beni Suef Province, the Nile level on 12th August was sufficiently high at Sharahnah to feed Hod Sultani, and the old Mazurah Head in the South West corner of Hod Sultani also passed in a small quantity of water on 19th August. From 28th August Hod Sultani maintained a gradual rise to the end of September, and was then brought up rapidly from the Yusufi by regulation on Mazurah.

“All the basins to the north of Sultani filled well; Hod Koshesshah was low all through September, and first half of October, but had a good watering in the second half of October; Hod Riqqah had a high level all through September and October.

“In Asyut, Hod Tunah and its Hosha were brought to T.R. level by 8th October from Hod Delgawi, feeding through Hatatbah Bridge. Hod Beni Khalel was left low till 28th September, and was brought up to T.R. level by 6th October, on which date it was let go, so as to allow part of the Yusufi sarf wave from Delgawi escape to pass

through it by means of its new big 5 arch escape. After 9th October it was up again to T.R. level on 12th October: to prevent the Hod falling when it has once reached T.R. level, it would be best to open the Beni Khaled escape simultaneously with the Delgawi escape.

“ The West of Yusufi Minia basins were brought up to T.R. levels during the last week of September, except Hods Tukh and Bortobat, the southern Hods respectively of each system, which were brought to T.R. levels in October by the surf wave in the Yusufi.

“ In Beni Suef Province, by regulation at Mazurah on 29th September Hod Sultani was brought up to T. R. level on 12th October and was kept full till the end of October to give the Southern end a good flooding in the last year before conversion to Sefi. The surplus water of the Hod, obtained from the Sultani Nili feeder, which was also working efficiently, and was not closed down till 19th October, was passed on to the northern basins, Nina Nuerah, and Bahabshin, which were all up to T.R. levels by 20th October, and kept so until 29th October. Hod Kosheshah began to feel the Yusufi Sarf wave on 16th October, and from this date rose rapidly to its T. R. level of 26.75 on 24th October and was maintained at that level for 5 days.

“ Hod Riqqah was brought to T. R. level on 20th October. ”

Discharge of the Basins.—(5th Circle).—The following statement gives the dates of the commencement and completion of the Sarf operations in the different systems:—

NAME OF SYSTEM.	Sarf operations commenced.	Sarf operations completed.
	Between : —	Between : —
Ramadi	8th October and 16th October	25th October and 7th November
Asfun	8th .. 14th ..	25th .. 10th ..
Fadiliyah... ..	8th .. 19th ..	21st .. 31st October
Sahil Far-shut...	8th .. 17th ..	20th .. 4th November
Killabiyah ...	4th .. 8th ..	24th .. 26th October
Bayyadiyah ...	11th .. 21st ..	21st .. 5th November
Shanhuriyah ...	18th .. 26th ..	24th .. 8th ..
Ghilasi	19th .. 24th ..	28th .. 7th ..

Girga Directorate.—The following statement gives the dates of the commencement and completion of the sarf operations in the different systems:—

NAME OF SYSTEM.	Sarf operations commenced.	Sarf operations completed.
	Between:—	Between:—
Khiyam	3rd October and 11th October	27th October and 30th October
Aklimim	3rd .. 15th ..	19th .. 30th ..
Khizindariyah...	3rd .. 9th ..	19th .. 30th ..
South Sahag ...	3rd .. 13th ..	21st .. 7th Nov.
North	5th .. 20th ..	16th .. 30th October

Asyut Barrage Directorate.—The following statement gives the dates of the commencement and completion of the sarf operations in the different systems:—

NAME OF SYSTEM	Sarf operations commenced.	Sarf operations completed.
Asyut Delgawi... ..	9th October.	24th October.
Asyut Deirut E... ..	8th ..	25th ..
Abnub... ..	9th ..	20th ..

4th Circle.—The sarf operations along the Yusufi canal from Deirut to Kosheshah are very interesting owing to the absence of the artificial wave, which was formerly created by cutting the tarrads of the eastern Minia basins, now converted to perennial irrigation. Mr. Clowes writes as follows:—

"Delgawi basin was let go on the morning of 9th October, but owing to the usual amount of water not being in the Yusufi, because of the non-flooding of the sahels between Deirut and Masraf Delgawi, the necessary level of 45.20 in the Yusufi below Delgawi escape was not reached until 10th October, and this was only obtained by sending a flush of 30 cent. down from Deirut for 24 hours, the levels there being raised from 45.30 to 45.60. Hod Tunah was let go on 9th October.

The sarf wave passed down the Yusufi and the crest of it reached the main regulators on the following dates:—

Nazlet-el-Abid	13th to 16th October
Saqula	17th to 20th ..
Mazurah	19th to 22nd ..
Lahun	24th to 27th ..

“Nazlet-el-Abid Lock and Regulator were fully opened on the afternoon of 12th October. The sahels along Hods Tnkh and Qamadir were flooded by means of Hoshahs, to fill which and not to delay the sarf, numerous cuts were made, namely three in Tnkh Tarrad on 11th October, and five in Tarrad Qamadir on 13th and 14th October. For the sahels north of Salibah Shushah, it was found necessary to cut tarrads Shushah and Tirfa on 16th October; the escape of Hod Tirfa on to the Yusufi was opened on 15th October, and El-Der Escape fully opened by 18th October.

The Saqula Lock and Regulator were fully opened on the afternoon of 16th October; Tarrad Hariqah was cut on 17th October for flushing the Yusufi sahels, and the Shenara and Delhanis escapes were opened on the same date.

No Sharaki on the Yusufi was left throughout the Asyut and Minia provinces.

Mazurah Lock and Regulator where fully opened on the afternoon of 18th October, and, as a level of 31.20 was obtained downstream on 19th October, no sharaki was left on the Yusufi in the Beni-Suef province.

Hod Kosheshah began to feel the sarf wave of the Yusufi from 16th October, and from this date rose rapidly, and, because of the high levels in the river, it was found necessary to check this rapid rise of the basin by partially opening the Kosheshah escape.

No sarf wave was required in the Nile for Lower Egypt, and the increase of river levels was limited to a flush of 30 cents giving a river gauge of 25.80 below Kosheshah escape: thus in order to get rid of the surplus water coming down the Yusufi, it was necessary to takhtif on the Kosheshah escape before the basin reached its T.R. level. On 22nd October eight of the lower gates were raised, and on 23rd ten gates were open, and on 24th and 25th fifteen gates. As the Nile rose at the escape, and the difference of the up and down-stream levels was not more than one metre, it was found possible to regulate with the lower gates and the basins was kept at T.R. level from 24th to 29th October. The flush in the river from 22nd to 23rd October being only 21 cents and the river levels commencing to fall away rapidly, the basin was easily discharged from the 24th October.

“When it was found that Hod Kosheshah was full, and the supply for Gizah through Komi could be maintained, the four Hods Sultani, Nina, Nuera and Bahabshin commenced their sarf en to Hod Kosheshah from 29th October, by which date the wave in the Yusufi had diminished, as indicated by the Lahun gauge, where the fall commenced

from 28th October. Hod Riqqah was brought to T.R. level on 20th October and from 22nd October Komi bridge was opened to supply Gizah, the downstream levels being :—

22nd October	24.10	25th to 28th October	24.80	4th November	24.20
23rd ..	24.55	29th .. 30th ..	24.60	5th to 9th Nov.	24.50
24th ..	24.60	31st Oct. to 3rd Nov.	24.30	9th to 12th Nov.	23.50"

The Hod Riqqah was sarfed in the usual way.

Regulation between Circles.—Between the 5th Circle and Girga directorate no regulation was necessary.

Between the Girga directorate and the Asyut barrage directorate regulation was made on the Gebel Asyut in the usual way.

Between the 4th Circle and 3rd Circle all former rules for regulation were cancelled and the following substituted, viz :—

4th Circle.—From the commencement of the flood the El-Komi bridge was completely closed.

3rd Circle.—From the commencement of the flood the supply for the Gizah basins was taken from the Girzah canal, which was kept fully open.

3rd and 4th Circles.—As soon as Hods Kosheshah and Riqqah were full, the Komi bridge was opened to complete the Gizah basins according to the demands of the 3rd Circle.

Mr. Clowes points out how necessary it is that the Hoshahs in the Gizah province should be always ready by 10th to 15th October, so as to allow Komi Regulator to be opened as soon as the Yusufi water can be spared from the Kosheshah basin, instead of opening the Kosheshah escape on to the river, where the levels are necessarily limited. I entirely agree with him, and would fix 15th October as the latest date for opening the Komi Regulator, i.e. that the Gizah hoshahs and basins should be ready to take water on that date, if any is required, and the 4th Circle is prepared to give it.

Regulation at Deirut and in Yusufi.—Mr. Clowes, Inspector 4th Circle, has submitted the important and excellent diagram, Plate III, showing the flood regulation in the Yusufi from Deirut to Lahun during 1903, and the following useful information.

To obtain necessary flood levels at Deirut namely 46.75 in the Deirutiyah, 46.40 in the Yusufi, and 45.20 in the Ibrahimiyah below

Deirut regulator, it is necessary to have a level of 50.90 to 51 above the Asyut barrage.

In 1903 a level of 46.40 was first obtained in the Yusufi on 24th August, when the level above the Asyut barrage reached 50.96 on the 23rd August.

It is not possible to run a higher level in the Yusufi than 46.40 or perhaps 46.50 without flooding the sahels between Deirut and Badraman, and from the diagram it will be seen that there is very little water to spare north of Mazurah beyond the Fayum requirements, if Gizeh basins, when converted, are to be fed from Lahun. The amount available is that which now enters Hod Kosheshah, which will not be required when Kosheshah is converted to sefi, as it will receive its supply from the Ibrahimiyah at Sharahnah. Furthermore when the west of Yusufi basins in Beni Suef are constructed, a higher level above Mazurah will be required during September, but this can be obtained by not letting Nezlet-El-Abid upstream reach its T.R. level of 40.50 till 15th to 20th September instead of from 25th August as in 1903.

A supplementary supply can also be given to the Yusufi through Hod Delgawi, although a higher level than 46.40 cannot be run in the head reach of the Yusufi between Deirut and Delgawi escape.

When the Ibrahimiyah canal is commanding all the converted basins of Minia and Beni Suef provinces, through the Sabakah and Sultani canals respectively, it will be necessary to have flood rotations, and this will also be advisable to reduce the amount of drainage water.

Regulation during flood for drainage.—During the past few years arrangements have been made to discharge the drainage in the Minia province in flood direct on to the Bahr Yusuf, as long as the levels of the latter would permit; during the passage of the sarf wave, however, the levels of the Yusufi are higher than those in the Main Muhit drain, and, consequently, the outlets must be closed with the result that water accumulates in the drains, and great pressure is felt, especially in the Feshn district, where it is difficult to keep the drainage water from swamping the crops. In spite of all instructions, it is impossible to prevent the cultivators from allowing the surplus water of their irrigating channels to escape into the drains: it was decided, therefore, to adopt special measures of regulation.

Mr. Clowes thus describes what was done.

To relieve the Minia province drainage north of the Etsa Pumping station while the Yusufi sarf was in progress, the Ibrahimiyah canal

was lowered downstream of Deirut on the 11th October from 45.30 to 44.70 and kept at that level until 25th October. All branch canals on left bank of the Ibrahimiyah were closed north of Minia to Sharahnah during those 15 days, and no complaints were received for water in this area for irrigation. The reduction of the drainage was completely successful and fortunately the drains were comparatively empty when the breach occurred in the Muhit bank on 16th-17th October, north of Abu Rahib, the discharge from which would have swamped out the Feshm district.

The Abu Rahib drainage escape was closed on 7th October as the Yusufi levels rose above those of the drain on 8th October; the Mazurah drain was closed on 17th and 18th October reopened on 19th October, reclosed on 20th, and again opened from 21st October, and remained so to the end of the year: from 17th October to 5th November, however, the discharge from it could have been but little as the levels in the Yusufi during that period were above 39.90 downstream of the Mazurah regulator.

Further relief was given to the drainage of Feshm by cutting the saddle in the Absug Brain at Sharahnah on 3rd November, and letting that branch drain discharge out into the Nile. With a system of rotations during flood on all canals in Asyut and Minia of the old perennial area, and of the converted basins, it will be possible to keep the Mazurah drain low, and probably working continuously except during the period of the passage of the Yusufi sarf, when it will be advisable to close down all the canals for a period of a week or 10 days. This very important regulation will be repeated next year, and if found successful, it will be possible to do away with pumping stations in this reach altogether.

Sharaki expenditure.—In making Hoshahs and other special works for preventing sharaki the following expenditure was incurred:—

In the 5th Circle...	...	...	L.E.	897	Special low Nile credit
In the Girga Directorate...	...	..	..	680	.. .. ..
In the Girga Directorate...	...	..	..	139	Ordinary budget
In the 4th Circle...	...	...	..	1724	.. ..
				<hr/>	
Total ...	...	...	L.E.	3440	
				<hr/>	

Sharaki areas.—The only areas left unirrigated were in the isolated basins of the Aswan district, and on high islands and sahels in the

river, the total of which should not exceed 5000 feddans ; parts of this will probably be irrigated by lift during the winter.

Accidents and breaches during flood.—The breaches which occurred were :—

(1) Left bank of the Ibrahimiya canal at Beni Mazar on the night of 25th August, due to the negligence of the cultivators in not protecting a private outlet. Water was pumped out of the birkets in the village by a staff and pump sent down by the Asyut barrage directorate : practically no damage was done.

(2) Breach in Tarrad Hod Qayat opposite Ezbeh Nagagi Pasha on 23rd September, which was quickly closed.

(3) Breach in Yusufi East Tarrad (on Muhit bank) north of Abu Rahib escape, due to negligence of watchmen. It was soon closed and as the Muhit drain had little water in it at the time, because of the closure of branch canals of the Ibrahimiya north of Etsa for 15 days, no damage occurred to the low lands at Feshm : this was mainly due to the satisfactory working of the Mazurah drain.

Accidents.—At the end of the year, it was found that a large piece of the extension of the downstream floor of the Deirut escape had been completely broken up ; the necessary repairs and the division of the lock into two bays, estimated to cost L.E. 6500, will be carried out in 1904.

SECTION IV.—FLOOD WATCHMEN.

Nile Corvée.—The total number of men called out was 17,651; the average number of days they remained out was 56 ; the total number of days labour was 992,132. The following statement gives the distribution of the men in the different circles. In the Projects Circle the men were called out for the protection of the banks of the new canals, in connection with the conversion works of the Minia basins.

NUMBER OF CORVÉE MEN CALLED OUT DURING THE NILE FLOOD OF 1903.

Circles and Provinces.	NILE BANKS.				BASIN BANKS.				CANAL BANKS.				BRIDGES.				RESERVE.		TOTALS.	
	Number of men called out.	Average number of days out.	Length of banks in kilometers.	Average number of men per kilometer.	Number of men called out.	Average number of days out.	Length of banks in kilometers.	Average number of men per kilometer.	Number of men called out.	Average number of days out.	Length of banks in kilometers.	Average number of men per kilometer.	Number of men called out.	Average number of days out.	Number of bridges.	Average number of men per bridge.	Number of men called out.	Average number of days out.	Number of men called out.	Average number of days out.
1ST CIRCLE.																				
Fayum...	—	52	82	3	90	30	169	8	255	17	86	2	80	95	—	—	125	91	—	—
Beni Suef...	316	371	137	3	1377	28	178	12	110	14	12	1	210	23	35	1	2503	33	130	53
Mina...	371	371	137	3	291	31	13	12	17	11	366	2	116	61	—	—	2215	27	150	3
Asyut North...	910	69	129	7	152	—	—	—	983	38	—	—	170	—	—	—	2215	55	—	—
Total...	1627	—	—	—	2210	—	—	—	1395	—	—	—	636	—	—	—	6718	51	880	—
PROVINCIAL CIRCLE.																				
Mina...	—	—	—	—	—	—	—	—	2896	88	—	—	—	—	—	—	2896	88	—	—
5TH CIRCLE.																				
Kom...	278	11	186	1	118	31	117	3	96	38	75	1	268	11	236	1	1138	37	8	27
Aswan...	20	10	18	1	17	8	11	1	—	—	—	—	31	57	17	2	72	32	1	38
Total...	298	—	—	—	135	—	—	—	96	—	—	—	302	—	—	—	1210	37	9	—
GIRGA DIRECTORATE.																				
Asyut South...	176	35	96	2	117	33	35	2	108	55	71	1	168	70	57	3	579	20	10	62
Girga...	511	51	229	2	1152	19	291	1	1177	19	512	2	501	61	188	2	3671	51	—	—
Total...	717	—	—	—	1269	—	—	—	1585	—	—	—	669	—	—	—	1250	55	10	—
ASYUT BARRAGE DIRECTORATE.																				
Asyut...	534	38	147	1	1112	13	141	3	171	45	101	5	130	57	—	—	2517	45	—	—
Grand Total...	3175	—	—	—	5096	—	—	—	6113	—	—	—	2037	—	—	—	17651	56	899	—

SECTION V.—DRAINAGE.

All new drainage channels made during the year will be described under the head of special works.

In the clearance of drains 267,330 m.c. were executed at a cost of L.E. 3,413.

The Etsa Pumping Station was worked during the flood of 1903 for the first time ; as the station was still under the Project Circle its working will be described under the head of "Special Works".

Levels of Lake Qarun.—The following table gives the levels of Lake Qarun on the 1st of March for the past 20 years.

YEAR.	Level of lake in metres below sea-level.	Fall in previous 12 months.	YEAR	Level of lake in metres below sea-level.	Fall or rise in previous 12 months.
1885	39.89	Unknown.	1895	44.17	0.33
1886	40.00	0.20	1896	44.16	0.11 rise.
1887	40.38	0.38	1897	44.27	0.11 fall.
1888	40.73	0.35	1898	44.32	0.05 ..
1889	41.17	0.44	1899	44.25	0.07 rise.
1890	42.00	0.83	1900	44.10	0.15 ..
1891	42.78	0.78	1901	43.90	0.20 ..
1892	43.32	0.54	1902	44.19	0.29 fall.
1893	43.78	0.46	1903	44.43	0.24 ..
1894	43.84	0.06	1904	44.72	0.29 ..

There would seem to be little danger of an appreciable rise in the level of the Lake, notwithstanding the increased supplies entering at Lahm.

Part II.—RESERVOIR WORKS.

SECTION I.—EXPENDITURE.

The total grants made for the Reservoir Works are as follows :—

	£-s-t.	L. E.
Original allotment	2,000,000 or	1,950,000
Caisse Grants... ..	1,342,263	1,308,706
Total... ..	<u>£-s-t.3,342,263 or</u>	<u>L.E.3,258,706</u>

The total expenditure was as follows :—

To Messrs. Aird & Co. up to Final Certificate	3,320,272 or	3,237,265
Cost of materials taken over by Government	6,053	5,902
Total... ..	<u>£-s-t.3,326,325 or</u>	<u>L.E.3,243,167</u>

leaving a balance of L.E.15,539 which was used for payments of land, etc., expropriated.

The total expenditure of L.E.3,243,167 may be approximatively divided as follows :—

	L. E.
Aswan Reservoir Dam and Locks	2,370,081
Asyut Barrage and Ibrahimiyah Canal Head	873,086
Total... ..	<u>L.E.3,243,167</u>

Although a complete delivery of the works to the Government was made on 10th December 1902, the final payment to the contractors could not be made, according to the specification, until two months after the completion of the works.

A final payment was made to Messrs. John Aird & Co. by certificate No. 55 on 4th April 1903, amounting to £-s-t.3,320,272 or L.E.3,237,265.

The following statement shows the yearly and total expenditure in pounds sterling on the Reservoir Works during the years 1898-1903, according to the payments made to the Contractors.

STATEMENT SHOWING THE EXPENDITURE ON RESERVOIR WORKS
TO END OF 1903.

	Expenditure in						TOTAL
	1898	1899	1900	1901	1902	1903	
	£	£	£	£	£	£	£
Permanent work, Aswan Dam ...	20,885	273,075	567,016	840,921	298,560	1,514	2,001,971
Retention under clause 39 of Specification ...	3,132	29,264	601	—	—	33,000	—
Payment on account of Permanent work ...	17,753	243,811	566,412	840,921	298,560	34,514	2,001,971
Advance on Preliminary works, Aswan Dam ...	20,729	72,746	71,029	138,292	26,212	—	—
Advanced on Plant ...	31,040	33,545	8,915	56,844	18,826	—	—
Advanced on Materials ...	25,376	142,813	45,635	137,916	75,958	—	—
Advanced to Messrs Ransomes and Rapier ...	—	55,972	69,133	106,693	96,718	16,491	315,037
Total payment on account of Aswan Dam ...	94,898	568,887	743,341	614,562	274,312	51,005	2,347,008
Advanced on account of Aswat weir and Lock ...	16,021	271,917	240,765	232,740	75,960	860	869,546
Advanced on account of payment for land ...	23,400	12,460	4,500	500	—	—	40,500
Advanced on account of Import Duties ...	8,100	18,900	13,000	9,000	1,249	—	47,751
Subsidiary works ...	3,934	8,734	1,315	1,526	1,969	622	15,467
TOTAL ... £st.	176,357	883,535	1,000,293	878,328	350,992	50,767	3,320,272

From the commencement of the preliminary studies the total expenditure on the Reservoir Works, exclusive of permanent establishment is as follows :—

	L.E.	L.L.
Expenditure as shown above ...	3,213,167	
Preliminary surveys, and preparation of projects 1894 to 1897 inclusive ...	18,673	
Temporary establishment, permanent buildings, maintenance &c., 1898-1903 ...	84,319	
	<u>3,316,159</u>	

The two last items were found from the ordinary budget.

In addition to the above the Finance Department contributed on account of the Reservoir Works, for land and property expropriations and compensation, a sum of L.E. 124,346 so that the total expenditure from the commencement to the completion becomes L.E. 3,470,505.

Since the commencement of 1903 the Asyut barrage works have come under the newly formed Asyut Barrage Directorate, and from the commencement of 1904 the Aswan Reservoir Directorate has also been created, and separate allotments in the ordinary budget, under Chaps. IX. 8.4 & IX. 10.4 respectively, have been granted. At the end of December 1903 the extraordinary expenditure on Reservoir Works ceased, and in future the expenditure will be shown under ordinary budget.

SECTION II.—THE ASWAN RESERVOIR.

(Filling and Discharging the Reservoir).

Filling.—For the season 1902-1903 the filling of the reservoir was commenced on 20th October 1902 and continued till the end of January 1903, when the full level of R.L. 106.00 was reached. In last year's report the reasons for this early filling are given, and it is also stated that "it is certainly not advisable to repeat this programme except under similar conditions" on account of the silt deposit which might result. As far as can be ascertained the silt deposit has been very little, at all events not sufficient to appreciably diminish the contents of the reservoir: whatever silt is deposited, seems to a great extent to have been scoured away in the following flood.

Fortunately it has not been found necessary, owing to the better supply in the river, to commence filling for the season 1903-1904 till the 1st December, and to complete it by the 12th March.

From 1st February to 10th March 1903, the reservoir was kept full, and the river supply passed through the upper sluices.

Discharging.—On the 15th March 1903 it was decided, owing to the low levels in the river, to commence the discharge in order to supplement the supply of the Ibrahimiyah canal and to maintain the levels required for Lower Egypt.

On the 1st May the demands for Lower Egypt commenced and rapidly increased towards the end of the month.

The following quantities were discharged from the reservoir and added to the river supply.

From March 10th to March 26th					1 million cube metres per day				
..	..	26th	..	May 1st	2	..	..	..	..
..	May	1st	..	.. 20th	4	..	..	..	..
..	..	20th	..	June 3rd	11	..	..	..	..
..	June	3rd	..	.. 25th	30	..	..	..	..

At the end of June the rise from the south commenced to reach the reservoir and maintained the levels in the river which had been artificially produced by the discharge of the reservoir water. The discharge of the river itself in June was about 20 million cubic metres per day, so that the reservoir discharge practically doubled the available supply at the most critical time for the irrigation of the summer crops.

The filling and discharging of the reservoir entails an immense amount of calculations and diagrams, constant watching of the river levels, and careful manipulation of the sluices of the Dam. Considering that this was the first year of the reservoir's existence, and that there was no previous experience of its working, Messrs. May and Macdonald and their staff deserve great credit for the successful regulation of the supply.

Results of the working of the reservoir.—The levels in the river south of Halfa were very low during the latter part of March, throughout April, and May, and the early part of June, in fact lower than the exceptionally bad levels of 1902, as shown on Diagram I: without help, therefore, from the reservoir the supply would have been quite inadequate for the irrigation of the summer crops, and great difficulty would have been experienced in saving the cotton crop.

The result of the discharge of the reservoir was to give an ample supply in Middle and Lower Egypt at least one month earlier than would have been the case without the reservoir: the rotations were everywhere relaxed early in July instead of the middle of August: the prohibition to irrigate the land for planting the dura crop was removed one month earlier than had ever been done in previous years: the irrigation of rice, which had been prohibited in previous years, was again allowed: and, finally, the whole cotton crop was plentifully irrigated.

In Middle Egypt 170,000 feddans of basin lands were converted to perennial irrigation, thus giving an increased annual rental of L.E. 500,000 and an increased value of the land of L.E. 5,000,000.

SECTION III.—THE ASYUT BARRAGE.

Regulation for purposes of navigation was commenced on the Asyut barrage on 20th March: afterwards it was continued for irrigation.

The greatest head on the Barrage was 1.30 m. on 2nd April, the up and downstream levels being R.L. 46.95 and R.L. 45.65 respectively: the Barrage was fully opened on 14th August.

The results of the regulation are shown in Part I, Section I of this report.

SECTION IV.—SUPPLEMENTARY WORKS.

New Sahel Lock.—In order to improve the navigation in the river between the Aswan dam and Aswan town, it was decided at the end of 1902 to construct a new lock at the Sahel rapid, where boats experienced great difficulty in passing. The work was put into adjudication and entrusted to Messrs. Williamson and Urquhart, who successfully completed the work in one season, so that the ironwork was all fixed to enable the lock to be worked in July 1903. The ironwork was supplied by Messrs. Ransomes and Rapier, and is of their usual excellent quality and workmanship.

The total cost of the Lock was L.E. 49,331, which was made up as follows :—

	L.E.	
Caisse Grant	25,000	
Advance by Finance Department	15,539	
Balance from Philæ Temples	6,993	
	<hr/>	L.E.
Ordinary Budget		47,532
		1,799
Total... ..		<hr/> <hr/> L.E. 49,331

The Lock has been quite successful, and when the lateral banks have been completed, navigation should be perfectly safe at all seasons.

Apron downstream of the Dam.—In order to protect the river bed immediately under the upper sluices of the Dam and prevent erosion at the toe of the wall, it was decided to put in a masonry apron. On the western side the work was completed before the flood at a cost of L.E. 5,474, which had been advanced by the Finance Department and is to be recovered from the Caisse Grant in 1904.

Philæ Temple.—No expenditure was incurred during 1903. The Caisse Grant for the consolidation was L.E. 19000 and the expenditure L.E. 12,007 leaving a balance of L.E. 6,993 which was utilised on the New Sahel Lock.

Part. III.—SPECIAL WORKS.

(Chargeable to Special Caisse Credit and Special Grant from Ordinary Budget).

The sum available for expenditure on special works during the year was as follows :—

	L.E.
Special Caisse Grant	423,436
Special Grant from Ordinary Budget	15,138
Total... ..	<u>L.E. 438,574</u>

The total expenditure was L.E. 438,456, leaving a balance of L.E. 118 to be carried forward, or, excluding the balance on the Ordinary Budget, which will lapse, L.E. 117 only.

In addition to the above the Finance Department made the following advances, which are to be recovered from the Special Caisse Grant of 1904, viz :—

Conversion Minia basins.—

	L.E.
Works	38,133
Land	64,756
Total... ..	<u>L.E. 102,889</u>

Of this amount L.E. 38,133 were spent on works and L.E. 22,578 on land, leaving a balance of L.E. 42,178 for land payments in 1904.

The total amount available for expenditure was, therefore, as follows :—

	L.E.
Special Grants from Caisse and Ordinary Budgets	438,574
Advances by Finance Department to be recovered in 1904	102,889
Total... ..	<u>L.E. 541,463</u>

and the expenditure was as follows :—

	L.E.
On Special Grants	438,574
On Advances by Finance Department	55,806
Total... ..	<u>L.E. 494,380</u>

Leaving a balance of L.E. 47,083 to be carried forward to 1904, or, excluding the Ordinary Budget which will lapse, L.E. 47,082 only. This balance will be paid in 1904 for land, for which all formalities were not complete in 1903.

Appendix F, gives a general abstract showing the distribution of the expenditure on the various projects namely:—

4th Circle.—

	L.E.	L.E.
West Hafiz Gannabiyah... ..	65	
Waladiyah Syphon	600	
Asyut converted basins	3,799	
Fayum remodelling projects	67,882	
	<hr/>	72,346

Projects Circle.—

Asyut basin conversion	3,100	
Southern Minia basin conversion	60,002	
Northern	154,079	
West Gizeh	4,740	
Enlarging Ibrahimiyah canal	101,510	
Remodelling Muhit Drain	52,750	
Etsa Pumping Station	25,898	
Establishment, Temporary and Contingencies... ..	15,955	
	<hr/>	418,034

5th Circle.—

	<hr/>	<hr/>
	4,000	4,000
Grand total... ..	L.E. 494,380	<hr/>

The appendices G and H give the details of the expenditure on the various masonry works, new channels and banks constructed, and existing channels re-modelled during the year.

The following note gives the details of each project taken in hand, or advanced during the year:—

4th Circle.—West Hafiz Gannabieh.—The small sum spent was for land, the project having been completed in 1902.

Waladiyah Syphon.—The expenditure of L.E.600 was the balance due on work done in 1902. The pipes were re-sunk, but the end lengths could not be attached, owing to heavy slips of the canal bank when excavating the pit, and the early rise of the flood stopped completion of the work. It has been decided to raise the pipes, and re-sink them in 1904, with parts of the end lengths already attached.

Asyut converted basins.—A sum of L.E.3799 was spent on a few small branch canals and drains found necessary after the first year of working of the sefi canals in the newly converted basins, and in the construction of five small masonry culverts, and three road bridge regulators. Some iron pipes were also provided in drains where village roads crossed them. Two iron pipes were also fixed under the Muhit bank to drain two local depressions on the west of the Muhit in Hod Itqa into the Muhit drain.

This project has now been completed and handed over by the Project's Circle to the 4th Circle. The total expenditure in converting 58,085 feddans from basin to perennial irrigation, excluding the widening of the Ibrahimiyah Canal, Muhit drain and Etsa Pumping Station which will be spread over the whole area of Middle Egypt, is L.E.184,081 i.e., the cost of the actual conversion works in the basins becomes L.E.3.17 per feddan of converted area.

Fayum Remodelling Projects.—The total expenditure on new works in the Fayum during 1903 was L.E. 67,882 of which L.E.2,526 was for establishment and L.E.65,356 for works.

The projects taken up or advanced were :—

<i>Canals.</i>	Completion of 2nd Reach of Abdallah Wahbi Canal and branches.									
	Excavation of 3rd " " " " " " " " " " " "									
	Baher Serb and branches.									
<i>Drains.</i>	Remodelling Baher Makatalah and branches.									
	Serb Drain.									
	Remodelling drains of Baher Serilah.									
	" " " " " " " " " " " " Rodah.									
	Masonry falls below Khazzan Tamiyah.									

The expenditure was as follows :—

Canals.—

	L.E.
Land	1,652
Earthwork	35,374
Masonry works	13,650
Ironwork in bridges and pipes	1,312
Rubble revetment	803
Demarcation stones	40
	<hr/> 52,831

Drains.—

	L.E.
Earthwork	7,000
Masonry works	4,420
Ironwork, pipes, &c.	115
Khazzan Tamiyah	660
	<hr/> 12,525
Total... ..	<hr/> <u>L.E.65,356</u>

At Tamiyah there has been in past years a small lake covering an area of 200 to 300 feddans, held up by the old masonry walls across the deep khor. Owing to the high level of water in this lake all the Serb, Rodah, and Rubiyet lands were considerably affected and could not get efficient drainage. It was decided to run off the water in the lake, and in future to maintain such a level above the Tamiyah Khazzan that would allow all the drains of the affected lands to work properly. Two wrought iron pipes, each of 1.50 metres diameter, were placed through the old retaining wall of the lake, and necessary masonry falls were constructed below. The sadd above the work was cut in October, and the lake lowered to the required depth.

The whole operation was neatly and most creditably carried out and the results have been quite satisfactory.

PROJECTS CIRCLE.

Conversion of Southern Minia Basins.—The conversion project for lod Tahnashawi, Quran, and Tahawi, forming the southern Minia basins, and comprising an area of 51,897 feddans, was carried out in 1902 and the canals were opened early in August of that year. During the flood the experience of the working of the canals showed what further works would be necessary to complete the system. These works were carried out in 1903 and consisted of clearances of canals, strengthening banks, excavating new channels, construction of head sluices, regulators, escapes etc.

Altogether the following were executed :—

Clearance of canals	... ..	195,151	M.e.	costing	2572	L.E.
Strengthening banks	... ..	289,393	"	"	3907	"
Masonry work	... ..	72	No.	"	8212	"
Outlets pipes	... ..	1372	lm.	"	334	"
Revetment Bah. Yusef	... ..	5222	M.e.	"	1854	"

The new canals and drains and their extensions aggregated a total of $37\frac{1}{4}$ kilometres.

The total expenditure, including cost of land (L.E.37,029) incurred in 1903 was L.E.60,002. Adding this to the L.E.155,541 spent up to the end of the previous year, the expenditure to date becomes L.E.215,543. The estimated further expenditure for land, outlets, etc., is L.E.77,747, so that the total expenditure to complete the project becomes L.E.293,290, or L.E.5.65 per feddan converted.

Conversion of Northern Minia Basins.—The conversion project for Hods Deri, Mangatin, Membal, Bardanuhi, Garmissi, and Salaqusi forming the Northern Minia Basins and comprising an area of 55,433 feddans was carried out in 1903. The works were commenced in January, and water admitted to the canals on 10th August.

The total length of irrigation channels was...	...	...	310	kilometers
" " " " drainage " " " " "	"	"	230	"
" " number of masonry works " " " " "	"	"	293	No.
" " cube of earthwork " " " " "	"	"	5,749,984	M.c.
" " cost of earthwork " " " " "	"	"	99,815	L.E.
" " " " masonry works " " " " "	"	"	50,037	"

The total expenditure amounted to L.E.154,079.

To complete the project, including the cost of land, it is estimated that a further expenditure of L.E.77,670 will be necessary, making a total of of L.E.231,750 for the conversion of 55,433 feddans or L.E.4.18 per feddan of converted area.

Conversion of Hods Kom Saaydah, Sultani, Nina and Nuera.—The conversion project for these basins has been drawn up and approved. It has been decided to carry out the conversion of Hods Kom Saaydah and Sultani in 1904. In order to irrigate the sahel of the Bahr Yusuf in Hod Kom Saaydah an extension was made from the tail of the Sabakhah Canal to feed the Belhasa Canal at a cost of L.E.1,171.

Conversion of West Giza, Hods Qoshesha, and Riqqah.—The project for the conversion of these basins was studied and submitted in 1903: it consisted of the conversion of the whole tract into Sefi conditions. It has now been decided to modify the project, and to keep the western part, situated between the Lebeni channel and the desert under basin irrigation; the modified project is now being prepared. For the proposed Lahm Canal through Hod Qosheshah for supplying the Giza Province with sefi water (a part of the modified project) 21,380m.c. of rubble stone was collected at a cost of L.E.4,490. A sum of L.E.250 was also spent in printing the map of West Giza.

Widening Ibrahimiyah Canal.—In order to supply the converted basins of Minia, Beni Suef and Gizeh Provinces, it is necessary to widen the Ibrahimiyah Canal from Deirut to Ashmunt, a length of 207 kilometres, and of which the following have been taken in hand, viz :—

(a) Deirut to Minia...	...	...	Length 66 kilometres
(b) Minia to Matay...	...	...	" 40 "
(c) Matay to Mayanah ...	...	...	" 30 "

With the exception of the first section, which is being executed by dredgers, all the rest of the canal is widened by hand labour during a closure of 30 days in December of each year.

Deirut to Minia.—In October 1902 a contract was made with the Behera Company for hand work and dredging at an all round rate of 32 milliems per cubic metre: the work is to be completed by 1st December 1905. Handwork was commenced in December 1902, and dredging in May 1903. Considerable progress has been made with the hand work, but, owing to unforeseen difficulties, the cube dredged has been unsatisfactory, and in order to assure the completion of the work and not delay the conversion works in the basins, it has been decided to execute the greater part of the length between the Hafiz and Minia regulators during the closure of the canal in December 1904 and 1905. The quantities executed to date are 839,295m.c. of hand work and 231,400m.c. dredging: the total expenditure to date is L.E.33,999.

Minia to Matay.—The work in this reach, part of which was carried out in the previous year, was completed during a month's closure from 15th December 1902 to 15th January 1903. The expenditure during the year was L.E.51,333.

Matay to Mayanah.—The drywork only was executed from January to July 1903: the expenditure was L.E.17,274.

The wetwork was commenced during the closure of the canal in December 1903 and completed in January 1904, but no payment appears against the Budget of 1903: about 10,000 men were employed. The work has been excellent, and most creditable to those concerned: where completely finished, this magnificent canal can vie with any existing.

Altogether the expenditure on widening the Ibrahimiya Canal has been up to date L.E.165,035.

Remodelling West Muhit Drain.—The West Muhit Drain is the Main Drain for the newly converted basins of Asyut and Minia, as well as the old perennial area. It has been widened and remodelled from the Sabakhah Canal to Sharahnah, a length of 123 kilometres, and is now a most excellent and efficient drain. From Sabakhah to Etsa the remodelling was done in 1902.

From Etsa to Sharahnah, a length of 86 kilometres, the work was done in 1903, and with the exception of some bed clearance, which will be completed in 1904, was satisfactory. The expenditure in 1903 was L.E.52,750; and altogether L.E.79,431 has been spent up to date.

Etsa Pumping Station.—In the drainage project of the tract situated between the Nile and the Bahr Yusef from Deirut to Etza, was included a pumping station at the river end of the Etsa Nili Canal, in order to pump the drainage water into the river during the flood, when the level of the river would not allow the drains to work freely.

In September 1901 a contract was signed with Messrs. Easton & Co. Erith, Kent, for the supply of the necessary plant, consisting of four vertical direct acting engines of 165 I.H.P. each, four Easton centrifugal pumps of 40 inches diameter each, six boilers with a working pressure of 125lb per square inch, and all accessories. In May 1902 a contract was made with Messrs. Zaffrani, Annigoni and Gandolfi for the construction of the necessary buildings, with the exception of the two chimneys which were entrusted to Mr. Alphons Custodie of Dusseldorf.

At the commencement of August 1903 the whole installation was completed, and un-official trials were started of each engine, which were found satisfactory.

The pumps were worked continuously for lifting drainage water into the river from 6th October to 15th November, each engine running an average of 700 hours.

On 11th December Mr. Crawley commenced the official trials which lasted three days: he has submitted an excellent report on the results of these trials. Although the actual levels specified in the contract could not be obtained, and the slide valves had cut so badly that engine No. 4 had to be stopped before the completion of the trials, yet there is no doubt that the pumps can deliver 2 c.m. per second with a lift of 4·5 metres and 115 revolutions of the engines, and a coal consumption of 1·85 lbs. per H.P. per hour according to the specification.

Mr. Crawley has pointed out certain defects in the machinery, the most serious of which is the cutting of the valves and cylinder faces which he attributes to the bad quality of the material supplied: a sum of L.E.1,000 has been retained to rectify the defects, as far as possible, but Mr. Crawley is of opinion that piston valves should have been specified, and it is more than probable that it will be cheaper in the long run to adopt them, though the first expense will be somewhat costly.

With the exception of this defect, the whole installation has been well arranged and creditably executed.

The expenditure during 1903 was L.E.25,898 and up to date L.E.42,937: a further sum of L.E.2,200 is required in 1904 for the construction of quarters, coal store, tools, etc., so that the final cost of the whole installation will be L.E.45,137.

Cost of Conversion Works.—Exclusive of the cost of the widening of the Ibraniyah canal, remodelling the main Mubit Drain, Etsa pumping station, petty works and temporary establishment, the cost of the actual conversion works in the basins themselves is as follows:—

Asyut Province.—

							L. E.	M.	
Original estimate	...	...	...	...	...	...	2	005	per feddan.
Revised ..	...	...	...	...	...	...	2	034	"
Actual ..	...	...	...	...	...	...	3	017	"

Minia Province.—

							L. E.	M.	
Original estimate	...	...	...	...	...	...	3	015	per feddan.
Revised ..	...	...	...	...	...	...	4	055	"
Final ..	...	...	...	...	...	...	4	089	"

Beni Suef and Gizeh Province.—

							L. E.	M.	
Estimate	...	...	...	...	...	...	4	—	per feddan.

It will be seen from the above figures that the original estimates have been more than doubled, and L.E.4.000 to L.E.4.500 per feddan converted is the average price which it is estimated the whole of the actual conversion works from Deirut to the Delta Barrages will cost. The reasons for the increased cost are as follows:—

(a) In the Asyut Basins the cost of land was L.E.30, whilst in the Minia, Beni Suef, and Gizeh Basins it will not be less than from L.E.45 to L.E.50 per feddan, owing to the great rise which has taken place in the value of basins lands since the commencement of the conversion works.

(b) In the Asyut Basins the main canal of the system already existed, whereas in the Minia, Beni Suef, and Gizeh Basins, it has to be constructed.

(c) Owing to the increased area of selt cultivation, the cost of labour has very much risen throughout Middle Egypt: the Sugar and Cotton Factories have considerably felt this, as it is difficult to get ordinary labourers for less than 5 P.T. per day against 3 P.T. a few years ago. The increased cost of labour has naturally produced a corresponding increase in the cost of the works, which is shewn as follows:—

	Earthwork per cubic metre.	Masonry per cubic metre.	Land per feddan.
	L. E.	L. E.	L. E.
Asyut Basins... ..	0.0125	1.150	30
Minia Basins... ..	0.0160	1.300	45 to 50

In the Asyut basins the actual cost, per feddan converted, for the land expropriated was L.E.0.52: in the Southern Minia basins it becomes L.E.1.60, owing to the extra value of the land, and to the increased area required for the main canal.

Total Cost of Conversion Works.—As stated above the cost of the widening of the Ibrahimiyah Canal, remodelling the main Mubrit Drain, and other works outside the basins themselves, has been omitted.

The following shows the total estimated cost of the Conversion Works in the Asyut, Minia, Beni Suef and Gizeh basins, comprising an area of 451,000 feddans and including all subsidiary works:—

	L. E.
Actual Conversion Works... ..	1,739,506
Widening and extension of Ibrahimiyah Canal	512,383
Gizeh Canal from Lahun... ..	171,000
Drainage channels main Mubrit and new main drain ...	267,336
Pumping Stations	150,000
Establishment and petty works for six years... ..	180,000
Total... ..	3,020,225
Contingencies... ..	179,775
Grand Total	3,200,000

or L.E.7 per feddan converted from basin to perennial irrigation.

Result of the Conversion Works.—Up to the present 170,000 feddans have been converted from basin to perennial irrigation, and assuming the total final cost, as distributed over the whole final area of 451,000 feddans, to be L.E.7 per feddan, the expenditure will be L.E.1,190,000. The result has been to raise the rents at least L.E.3 per feddan and the value of the land at least L.E.30 per feddan in other words, by an expenditure of L.E.1,190,000 the increased annual rental is L.E.510,000 and the immediate increased value of the land L.E.5,100,000. Recent inspections show how very rapidly the cultivators, stimulated by the very high prices of agricultural produce now ruling in the market, have adapted themselves to the new conditions. In the first year very little sefi cultivation can be done, owing to the want of watercourses: in the second year more than half the area is under summer and flood crops: in the third year the whole area is under sefi conditions.

In the 5th Circle.—In making a new railway bank at Hod Hamad a sum of L.E.3,630 was spent and, in the Aswan District in minor works L.E.370, making a total of L.E.4,000.

Part IV.—WORKS AND ESTABLISHMENT.

SECTION I.—MAINTENANCE AND REPAIRS.

Details of the quantities of earthwork executed during the year and its cost, are given in Appendix D. The total quantities are as follows:—

CIRCLE	By hand.		Dredging.	
	Quantity.	Cost.	Quantity.	Cost.
	C.M.	L.E.	C.M.	L.E.
4th Circle... ..	3,865,990	48,045	—	—
5th Circle... ..	2,883,966	36,072	—	—
Girga Directorate	2,069,749	23,062	—	—
Asyut Barrage Directorate	638,388	7,323	100,000	8,914
Totals	9,458,093	114,502		

In the 4th Circle and Girga Directorate there is a considerable reduction, owing to the transfer of works to the newly formed Asyut Barrage Directorate.

The Ibrahimiyah Canal from the head to Deirut, together with its works and dredging, has been transferred from the 4th Circle to the Asyut Barrage Directorate. Under the new contract with Messrs. Duport & Jones a minimum cube of 100,000 M³ is guaranteed: the rate for this is 60 milliemes per cube metre for dredging and 10 milliemes for removal by hoppers making a total cost of L. E. 7,000. Making an allowance of L.E. 400 for lockage at the rate of 5 milliemes extra, the amount becomes L.E. 7,400 which has now been allotted under Corvée Abolition in the Asyut Barrage Directorate's Budget for 1904 and will be continued annually. If it is found that more dredging is required than the minimum cube of 100,000 M³, then the 4th Circle must find the funds to do the extra cube.

In 1903 a sum of L.E. 1,600 was spent in carrying the dredged material to fill up the old diversion channel of the canal which was used during the construction of the Head Regulator.

Altogether, then L.E. 7,400 + 1,600 = L.E. 9,000 was transferred in 1903 from the 4th Circle to the Asyut Barrage Directorate.

Spurs in the Ibrahimiya Canal.—There was no expenditure on spurs in the Ibrahimiya Canal during the year.

River Protective Works.—The following statement shows the cubes of stone purchased and built into river spurs and revetment, during the year, and the expenditure incurred on transporting and building Government stone into the same :—

CIRCLE.	NEW STONE		Transport and re-packing old stone	Total Cost.
	Cube.	Cost.		
	CM.	L.E.	L.E.	L.E.
4th Circle	2,392	325	133	458
5th Circle	2,312	370	12	382
Girga Directorate ...	4,029	1,029	490	1,519
Asyut Barr. Directorate	5,489	812	258	1,070
Totals... ..	14,222	2,536	893	3,429

In the 4th Circle L.E. 142 of the above was unpaid, and a further expenditure of L.E. 1,196 was incurred on 4439 M³ of stone used in the protection of Badbit et Matalra, which was badly attacked during the flood: these amounts will be paid in 1904. In the 5th Circle and Girga Directorate L.E. 407 and L.E. 220 respectively were spent in clearing off arrears of 1902; the former is not included in the above statement.

The following were the principal sites protected:—

4th Circle.—Wasta. Geziret El Masada & Head of Sultani Canal.

5th Circle.—Kasr Canal Head.

Girga Directorate.—Sohag, Qaramuta and Kikata. Asyut and Sohag.

Asyut Barrage Directorate.—Mangabad, Abnub, Ekrad and Wasta.

The following expenditure was incurred in revetting canal banks below regulators and other important points:—

CIRCLE.	NEW STONE		Transport and loading Govt Stone.	Total Cost.
	Cube.	Cost.		
	C.M.	L.E.	L.E.	L.E.
4th Circle	8,044	2,646	168	2,814
5th Circle	801	224	159	381
Girga Directorate ...	1,145	240	46	286
Asyut Barr. Directorate	3,826	765	—	765
Totals... ..	13,816	3,875	371	4,246

The following were the principal points where revetment was done:—

Minia Province.—Canals Nazlet Diab and Ethidem, Nazlet El Abid Regulator on Yusufi.

Beni Suef Province.—Mazurah Regulator on Yusufi.

Fayum Province.—Bahr Seilah, Yusufi Canal at Fayum town, and various small canals.

Assuan Province.—Ramadi Canal.

Girga Province.—Bayyaras of several regulators.

Asyut Province.—Ibrahimiyyah Canal, Delgawi-Yusufi bank.

In the Asyut Barrage Directorate 9,478 M³ of stone were collected for the Asyut Barrage Reserve, at a cost of L.E. 1,660 in addition to the above.

SECTION II.—NEW WORKS AND IMPROVEMENTS.

(*Exclusive of Special Works*).

Earthwork.—The quantity and cost of earthwork executed in new channels and banks was as follows :—

CIRCLE	Cube.	Cost.
	C.M.	L.E.
4th Circle	202,631	2,894
5th Circle	—	—
Girga Directorate	47,491	639
Asyut Barrage Directorate	64,708	776
Total	314,830	4,309

The lengths of the new channels and banks are given in the following statement :—

CIRCLE.	LENGTH IN KILOMETRES.	
	New Channels.	New Banks
4th Circle	46,691	2,014
5th Circle	—	—
Girga Directorate	9,014	0,984
Asyut Barrage Directorate	—	1,185
Total	55,105	4,183

The details are given in Appendix E: all the works were petty.

Basin Bank Protection.—Appendix K shows the progress made with and expenditure incurred on, revetting basin banks.

In the 4th Circle a length of 1003 metres was revetted on salibahs Qumadir and Shushah at a cost of L.E.1732. In the Girga Directorate 5493 metres of new revetment was executed at a cost of L.E.2852 and L.E.338 was spent of repairs to existing work.

In the 5th Circle and Asyut Barrage Directorate no basin bank revetment was done.

Owing to the conversion of the Asyut and Minia basins the banks have been suppressed and the stone used in the conversion works : the total up to date is therefore misleading, and will be adjusted when all conversion works are completed.

New Masonry Works for Irrigation.—A list of new masonry works and buildings charged to the Ordinary Budget is given in Appendix B.

In the 4th Circle the principal expenditure was on the Walidiyah Syphon, where the pipes were successfully sunk across the canal, but it was found impossible to connect the end pieces owing to a heavy slip of the Ibrahimiyah Canal bank round the wooden coffer dam constructed at the north end, and to the early rise in the river ; the pipes will be raised in 1904 and the end pieces attached before they lowered. The expenditure was L.E.1162 and up to the date L.E.5503.

In the 5th Circle the two principal works were a regulator in Salibah Hod El Gabbana and El Maamal Sayyala Head for Hod Edfu, costing respectively L.E.300 and L.E.548.

In the Girga Directorate no new works were built.

In the Asyut Barrage Directorate two small regulators were built at a cost of L.E.443.

The total expenditure under this head was L.E.3200.

Masonry Works re-modelled and repaired.—A list of the masonry works remodelled or repaired is given in Appendix C. The total expenditure under this head was L.E.14,581.

The principal work undertaken was the repairs to the Talihat Regulator on the Sohagiyah Canal which had been outflanked during the previous flood : a sum of L.E.6357 was spent in its restoration, leaving arrears of L.E.520 to be paid in 1904; this regulator has stood well during the flood.

The rest of the expenditure was for the usual maintenance and petty repairs of masonry works and buildings.

SECTION III.—AGRICULTURAL ROADS.

Nothing was done in 1903 for the construction of new roads in the Fayum in connection with the programme drawn up in 1898.

These roads are purposely being held up until the main lines of canals and drains in the remodelling projects are fixed; the remaining

roads will probably be taken in hand in 1904. A small expenditure of L.E.3 only was incurred for land taken up in past years. The usual budget allotment of L.E.1050 was spent on repairs to old agricultural roads in the four provinces of the 4th Circle: this sum is quite inadequate for keeping the roads even in decent repair.

In the Asyut Province a project for the construction of new agricultural roads to serve the converted basins was accepted by the Provincial Council in August 1903 and the Decree of Council of Ministers giving final approval was issued in November 1903.

The total length of the proposed roads is 64 kilometres and the estimated cost L.E.19,250. The project was prepared by the Project's Circle, but will be executed by the 4th Circle.

In the Minia Province a project was drawn up by the Project's Circle for the construction of new agricultural roads to serve the converted basins. The project comprises 28 roads extending over a length of $259\frac{1}{4}$ kilometres of which $171\frac{3}{4}$ are new and $86\frac{1}{2}$ old. The estimated cost of the $172\frac{3}{4}$ kilometres of new roads is L.E. 47,325 giving an average of L.E.274 per kilometre. At a meeting held at the Mudirieh in April 1903 the project was agreed to and it was proposed to spread the cost over the whole of the lands situated on the west of the Nile: the area amounts to 363,000 feddans and the share per feddan is L.E.0.135.—The project is now held up, pending the decision of the Daira Sanieh Administration regarding their contribution.

SECTION IV.—BRIDGES TO REPLACE FERRIES.

In the 4th Circle a new bridge with iron screw piles and masonry abutments was built at Abu Kerkas to replace the old wooden structure which had collapsed: its cost was L.E.1047.

A contract was also placed for the construction of a similar bridge across the Yusufi in the Faynu town, but no payment was made in 1903, though a considerable portion of the work had been done.

In the Project's Circle a new masonry bridge was built on the Ibrahimiyah canal at Sidds at a cost of L.E. 260.

A contract was also made for the construction of masonry and iron bridges on the Ibrahimiyah canal at Beni-Mazar, Abu, and Sheikh Ziad during the closure in December 1903: a sum of L.E. 1350 was spent on these, the balance is to be paid in 1904.

The total expenditure under this head was L.E. 2657.

In the Girga Directorate 18 bridges on masonry abutments and piers and steel joists carrying a wooden platform were built at a cost of L.E. 6555. Altogether 51 bridges have been built against the original programme of 49, and the balance of money available will be used up in building others. These bridges are paid for by a cess on the cultivated area of the Girga Province.

SECTION V.—WORKS OF PRIVATE ENTERPRISE.

Agricultural Railways in Fayum Province.—During 1903 no new lines were made: some bad curves were eased and a short length of track doubled at Metartaris station: the telephone posts were transferred to the side of the roads on which the rail track runs.

Nile Land Reclamation Works.—Mr. Dempster, Chief Engineer of the Nile Land Reclamation Works Co., writes as follows on the works undertaken in 1903:—

“*Garf Sarhan Reach.*—A masonry needle regulator with 25 openings of 3 metres each has been constructed at the tail of this reach, by means of which the flow of water is under command and is regulated to the velocity best suited to the deposit of silt. The flood of 1903 was but a moderate one and barely rose high enough for our wants. However, about one part in every 1000 of discharge was abstracted from all the water passing through the regulator and fairly good results were obtained.”

“*Saulat Reach, near Mellari.*—Here a masonry regulator of $120\frac{1}{2}$ metres, plus wooden girds 180 metres in length were constructed at the lower end of this reach. A much smaller percentage of the silt was deposited, though larger quantity in all was found within the reach, due to the much heavier discharges passed. Satisfactory deposits of pure clay were found at the lower end of the reach, though much sand was found at the top of the reach.”

“*Roluh Reach.*—Here also a masonry regulator 99 metres in length worked with wooden needles has been used to modify the velocities required for the best deposit of silt. A higher flood here, as at Garf Sarhan, would have suited our purposes better, but a good even deposit of pure clay has been obtained all over the reach. About 55 parts out

the 4th Circle, where he was much liked and respected: his departure will be widely felt.

Sidky Bey and Hussein Bey Wassif held charge of the 5th Circle and Girga Directorate respectively throughout the year, and successfully carried out the flood irrigation.

Abdallah Bey Wahbi did very good work on the remodelling projects of the Fayum.

Ismail Pacha Sirri held charge of the Project's Circle throughout the year, and carried out most successfully the very heavy programme of works in connection with the basin conversion Projects.

A. L. WEBB.

APPENDICES

APPENDIX A.

ABSTRACT OF EXPENDITURE IN 1903 UNDER THE DIFFERENT SUB-HEADS OF THE BUDGET.

SUB-HEADS OF BUDGET.	EXPENDITURE.					
	4th Circle.	Projects.	5th Circle.	Girga.	Asyut Bar. Dirte.	Total.
	L.E.	L.E.	L.E.	L.E.	L.E.	L.E.
SUB-CHAP. I.— <i>Establishment.</i>						
Classified	8,942	1,870	4,359	3,741	886	19,798
Hors Cadre	5,265	—	1,340	1,163	1,990	9,758
Total, Sub-Chap. I ...	14,207	1,870	5,699	4,904	2,876	29,556
SUB-CHAP. II.						
Travelling Allowance	3,628	—	1,358	1,192	223	6,401
Telegrams	227	—	234	156	18	635
Dahabiyahs	131	—	461	148	—	740
Office Rent and water	239	—	40	460	286	1,025
Sundries	10	—	49	18	5	82
Total, Sub-Chap. II ...	4,235	—	2,142	1,974	532	8,883
SUB-CHAP. III.						
Furniture and instruments ...	63	—	40	67	—	170
SUB-CHAP. IV.						
New works	228	—	1,189	900	443	2,760
SUB-CHAP. V.						
Repairs and Maintenance	8,630	—	3,017	5,005	8,058	24,710
SUB-CHAP. IV AND CORVÉE ABOLIT.						
Earthworks and works for decreasing the cost of maintenance of banks and channels...	60,739	—	37,500	32,568	17,757	148,564
Special new works	2,411	—	—	—	—	2,411
SPECIAL "CAISSE CREDIT."	69,935	419,645	4,000	—	—	493,580
NEW AGRICULTUR. ROADS & BRIDGES	3	—	—	6,555	—	6,558
SPECIAL LOW FLOOD CREDIT	—	—	897	681	—	1,578
FERRY FUNDS	1,047	3,500	—	—	—	4,547
SUMS COLLECTED UNDER CANALS ACT.	51	—	99	101	—	251
Total of Works ...	143,044	423,145	46,702	45,810	26,258	684,959
Grand Totals ...	161,519	125,915	51,583	52,755	29,666	723,568

APPENDIX B.

LIST OF NEW MASONRY WORKS EXECUTED IN 1903 AND THEIR COST,
EXCLUSIVE OF SPECIAL WORKS.

NAME OF WORK.	Cost.	Total per Province.	Total per Circle.		
	L.E.	L.E.	L.E.		
4TH CIRCLE.					
FAYUM PROVINCE.					
Abu Gandir and Serb Inspection houses	200	228	1,390		
Gaffirs hut Abdalla Wahbi Regulators	28				
ASYUT PROVINCE.					
Walidiya syphon	1,162	1,162			
5TH CIRCLE.					
KENA PROVINCE.					
Saliba El Gabbana Regulator	300	582		1,367	
Teima culverts... ..	153				
New store at Abu Hamad Escape	50				
Nilometre at head of Killabiyah Canal	50				
Khuzami Sayala syphon head	20				
ASWAN PROVINCE.					
El Maamal sayala head	548	785	1,367		
Sayala hod Bimban culvert	107				
Selwa road bridge	80				
Nilometre at head of Ramadi Canal	50				
ASYUT BARRAGE DIRECTORATE.					
ASYUT PROVINCE.					
Regulator Gizr El Haraz	340	443		443	
„ Hosha Assiouti	103				
Grand Total... ..				3,200	

APPENDIX C.

LIST OF MASONRY WORKS REPAIRED AND REMODELLED IN 1903 AND THEIR COST.

NAME OF WORK.	Cost.	Total per Province.	Total per Circle.	Grand Total.
	L.E.	L E.	L.E.	L.E.
4TH CIRCLE.				
ASYUT PROVINCE.				
Petty repairs to Bridges	200			
Repairs and alterations to Head Quarters ...	200			
" " S of C's houses ...	100			
Supply of regulating planks	316			
Repairs to Hasaybah Bridge	176			
" Deirut escape... ..	232			
		1,224		
MINIA PROVINCE.				
Repairs to Inspection houses	200			
Petty repairs to Bridges	500			
Repairs to C. E. office (arrears)	239			
Repairs to pipe culvert in W. Hafiz Gauna- biyah	110			
		1,049		
BENI SUEF PROVINCE.				
Repairs to Koshesha escape (arrears)	131			
" Syphon on Muhit drain	150			
Painting ironwork	114			
Petty repairs to Bridges... ..	580			
Repairs to Mazurah Regulator (arrears) ...	160			
" pipe syphon under Magnuna Canal	80			
Iron Syphon under Bahabshin Canal	310			
Painting Kosheshah gates	106			
		1,631		
FAYUM PROVINCE.				
Petty repairs to Bridges	500			
Repairs to Inspection houses	200			
" Aqueduct on Bahr Abuza	150			
" Kasr Gebali Bridge	146			
Pipe syphon El Gib drain	128			
Tamiyah aud Ayat road bridge	100			
Three culverts on Bahr El Nezla	277			
		1,501		
<i>Carried forward...</i>			5,405	

LIST OF MASONRY WORKS REPAIRED AND REMODELLED IN 1903 AND THEIR COST (*continued*).

NAME OF WORK	Cost.	Total per Province.	Total per Circle.	Grand Total.
	L.E.	L.E.	L.E.	L.E.
<i>Brought forward...</i>			5,405	
5TH CIRCLE.				
KENA PROVINCE.				
Repairs to Maalla Rest house	34			
„ Nag Hamadi house	36			
„ Hisha Escape... ..	100			
W. Branch Rannan Canal Head Regulator...	20			
Escapes Hods El Sahara E. and W.	35			
Repairs to El Namasa Regulator	36			
„ El Dimigrat Regulator	17			
„ Isna Rest house	32			
„ Qus Rest house and store	20			
„ Hod El Rakaik culvert	12			
„ El Massab culvert	11			
„ El Mussallia culvert	12			
„ El Gebalan escape	23			
„ El Tadiliyah Canal Head	15			
Miscellaneous Petty Repairs	154			
		557		
ASWAN PROVINCE.				
Miscellaneous petty repairs	43			
		43		
			600	
GIRGA DIRECTORATE.				
GIRGA PROVINCE.				
Repairs to Awlad Yehya Escape	218			
„ Isawiyah syphon	131			
„ Samanna West regulator	86			
„ Bayadi Syphon	22			
„ Enebis Escape	27			
„ Araba Idfa Escape	22			
„ Sahil Awlad Khalaf Culvert	20			
„ Un Dumah E. Escape	25			
„ „ W. Escape	50			
„ Faliha Regulator... ..	6,357			
Miscellaneous Petty Repairs	54			
		7,012		
<i>Carried forward...</i>			13,017	

LIST OF MASONRY WORKS REPAIRED AND REMODELLED IN 1903 AND THEIR COST (*continued*).

NAME OF WORK	Cost.	Total per Province.	Total per Circle.	Grand Total.
	L.E.	L.E.	L.E.	L.E.
<i>Brought forward...</i>			13,017	
ASYUT 2ND SECTION.				
Badari Salibah Regulator	15			
Madmar Escape	21			
Aqadma Regulator	91			
Abu Tig Escape	123			
Tisaa Regulator... ..	74			
Sultani Culvert... ..	111			
Shutb Escape	12			
Selim Escape	26			
Miscellaneous Petty Repairs	27			
		500		
			500	
ASYUT BARRAGE DIRECTORATE.				
Repairs to Abnub Bridges	399			
„ Asyut Bridges	150			
„ Manfalut Bridges... ..	200			
„ Deirut Bridges	200			
Miscellaneous Repairs	115			
		1,064		
			1,064	
				14,581

APPENDIX D.

EARTHWORK IN MAINTENANCE CHARGED TO REGULAR AND CORVÉE BUDGETS, UPPER EGYPT, 1903.

PROVINCE.	Repairs to banks.	Clearance of Nth canals and drains.	Clearance of Sth canals.	Clearance of Sth drains and new drains.	Closing of cuts.	Saddles in canals.	New canals and banks.	Repairs to agricultu- ral roads.	TOTAL.	COST.
	C.M.	C.M.	C.M.	C.M.	C.M.	C.M.	C.M.	C.M.	C.M.	Lds.
1TH CIRCLE.										
Fayum	180,191	—	211,365	78,761	—	—	—	—	173,317	6,876
Beni Suef	528,451	309,001	130,221	79,568	3,901	12,276	—	—	1,363,127	15,317
Minia	191,685	222,069	515,636	75,613	12,940	—	—	—	1,317,913	17,093
Asyut	91,396	29,183	521,950	33,388	2,086	—	—	—	681,393	8,729
Total, 1th Circle	1,291,726	560,556	1,685,172	267,330	18,930	12,276	—	—	3,865,990	48,015
5TH CIRCLE.										
Kena	107,618	1,971,215	3,896	—	13,192	66,155	—	—	2,162,376	20,688
Aswan	7,051	673,232	—	—	240	11,059	—	—	721,590	9,381
Total, 5th Circle	114,669	2,644,117	3,896	—	13,440	107,511	—	—	2,883,966	30,072
GIRGA DIRECTORATE.										
Girga	359,525	1,151,248	—	—	11,012	11,751	—	—	1,539,536	17,177
Asyut 2nd Section	212,409	308,311	—	—	9,193	—	—	—	530,213	5,586
Total, Girga Directorate... ..	571,934	1,462,559	—	—	25,505	11,751	—	—	2,071,749	23,063
ASYUT BARRAGE DIRECT.										
Asyut	249,196	268,129	—	—	56,055	—	64,708	—	638,388	7,323
Dredging Ibrahimiyah Canal	—	—	100,000	—	—	—	—	—	100,000	8,911
Total Asyut Barrage Direct.	249,196	268,129	100,000	—	56,055	—	64,708	—	738,388	16,237
Grand Total	2,227,825	4,935,691	1,789,068	267,330	143,930	131,511	64,708	—	9,566,093	123,117

APPENDIX E.

STATEMENT SHOWING THE NEW BANKS AND CHANNELS MADE IN 1903,
EXCLUSIVE OF "SPECIAL WORKS."

NAME OF WORK.	Length in kilometres.	Quantity of earthwork.	Total quantity.
		C.M.	C.M.
4TH CIRCLE.			
Diversion of Nile banks	2·014	38,676	55,425
Extension Sheikh Temai canal... ..	1·500	12,969	
Diversion Matay canal	1·484	3,780	
FAYUM PROVINCE.			
New branches Bahr El Maqatla	16·961	26,694	147,206
Bahr El Balad	3·096	10,956	
Diversion Bahr El Moarrabin	1·625	2,880	
Extension channel El Azab	1·152	1,286	
Bahr Arus remodelling	3·250	838	
East Bahr Etsa	1·144	124	
Channel for Malag Magoon Bey at Minia	3·200	8,879	
Channel Abu Radi at Minia	1·832	9,000	
Bahr Abuxa at Esbet El Khor... ..	0·140	555	
Remodelling Bahr Abuxa	3·253	33,751	
Remodelling Bahr El Wakf	8·054	51,943	
Total 4th Circle			202,631
GIRGA DIRECTORATE.			
GIRGA PROVINCE.			
Extension of Sayalet Nag Tamman E.	0·856	4,060	47,141
Sayalet Hod Banahu	1·610	7,874	
Sayalet Giziret Sawama	1·000	10,318	
Diversion of Nile Tarrad	0·984	15,662	
Extension of Sayalet Geziret Awlad Salim	0·743	9,227	
ASYUT 2ND SECTION.			
Extension of masraf Hod El Duer	4·805	10,350	10,350
Total Girga Directorate			57,491
<i>Carried forward</i>			260,122

STATEMENT SHOWING THE NEW BANKS AND CHANNELS MADE IN 1903,
EXCLUSIVE OF "SPECIAL WORKS"—*continued*.

NAME OF WORK.	Length in kilometres.	Quantity of earthwork.	Total quantity.
		C.M.	C.M.
<i>Brought forward</i> ...	—	—	260,122
ASYUT BARRAGE DIRECTORATE			
Diversion Salibah Beni Rafi	0·191	13,348	41,520
Diversion Salibah Muharraq	0·242	16,246	
Diversion Gizr el Karasy	0·752	11,926	
Grand Total... ..	—	—	301,642

ABSTRACT.

CIRCLE	New Channels.	New Banks.	Expenditure.
	Kilometres.	Kilometres.	L. E.
4th Circle... ..	46·691	2·014	2,894
5th Circle... ..	9·014	0·984	639
Girga Directorate	—	—	—
Asyut Barrage Directorate	—	1·185	483
Total... ..	55·705	4·183	4,016

APPENDIX F.

GENERAL ABSTRACT OF EXPENDITURE ON "SPECIAL WORKS" CHARGED TO SPECIAL CAISSE CREDIT AND SPECIAL GRANT FROM ORDINARY BUDGET.

NAME OF PROJECT.	NAME OF WORK.	EXPENDITURE.				
		Ordinary Budget.	Caisse Credit.	Total per Work.	Total per Project.	Total per Circle.
		L. E.	L. E.	L. E.	L. E.	L. E.
4TH CIRCLE.						
West Hafiz Ganabiyah	Land	—	65	65	65	
Walidiyah Syphon.	Walidiyah syphon under Ibrahi- miyah	—	600	600	600	
Asyut Converted Basins.	Pitching Masonry Earthwork Iron work	— 42 — 611	619 1,272 1,255 —	619 1,314 1,255 611	3,799	
Fayum Remodelling Projects.	Establishment Land for canals Earthwork in canals Masonry in in canals Revetment in canals Demarcation stones Ironwork Earthwork in drains Masonry in drains Ironwork in drains	— — — — — — 1,312 — — — 445	2,526 1,652 35,373 13,650 803 40 — 7,000 5,080 —	2,526 1,652 35,373 13,650 803 40 1,313 7,000 5,080 445	67,882	72,346
5TH CIRCLE.						
Railway diversion (Hod Hamad.	Earthwork	—	3,650	3,650	3,650	
Aswan district canals.	Earthwork	—	370	370	370	4,888
PROJECTS CIRCLE.						
Asyut Basins Conversion.	Cost of land	—	3,100	3,100	3,100	
Southern Minia Basins Conversion.	Strengthening canal banks Masonry works Irrigation outlets Stone for Bahr Yusuf Cost of land Working canals	— 785 — — — 1,027	11,730 7,652 334 1,435 37,029 —	11,730 8,447 334 1,435 37,029 1,027	60,002	
	Carried forward	—	—	—	63,102	76,346

GENERAL ABSTRACT OF EXPENDITURE ON "SPECIAL WORKS" CHARGED TO SPECIAL CAISSE
CREDIT AND SPECIAL GRANT FROM ORDINARY BUDGET (*continued.*)

NAME OF PROJECT	NAME OF WORK.	EXPENDITURE.				
		Ordinary Budget.	Caisse Credit.	Total per Work.	Total per Project.	Total per Circle.
		L.E.	L.E.	L.E.	L.E.	L.E.
	<i>Brought forward</i> ...	—	—	—	63,102	76,346
Northern Minia Basins Conversion.	Conversion works	1,800	151,309	153,109	154,079	
	Working canals	970	—	970		
West Gizeh Basins Conversion.	Printing west Gizeh maps	250	—	250	4,740	
	Stone for Lahun Canal	—	4,490	4,490		
Widening Ibrahimiiah Canal.	Widening Deirut to Minia	—	33,999	33,999	101,510	
	.. Minia to Matay	201	40,485	40,485		
	.. Matay to Mayana	—	17,767	17,762		
	Revetment Minia Etsa	—	2,151	2,151		
	Land-Minia-Matay	—	6,907	6,907		
Remodelling Muhit Drain.	Remodeling Etsa to Salibah Kom Saaydah and Absug drain	365	50,784	51,149	52,750	
	Land Sabakhah-Etsa... ..	—	1,601	1,601		
Etsa Pumping Station.	Buildings	500	19,521	20,051	25,898	
	Chimneys	620	—	620		
	Regulator on Etsa drain... ..	485	2,659	3,144		
	Fall on Etsa drain	—	1,652	1,652		
	Inspection House	461	—	461		
Temporary establishment and petty expenses.	Establishment and petty expenses...	—	15,489	15,489	15,955	418,034 *
	Portable wooden houses	466	—	466		
	Grand Total... ..	361,078	—	—	—	494,380

* Includes L.E. 60,712 advanced by Finance Department to be recovered from Caisse Grant of 1904.

APPENDIX G.

LIST OF MASONRY WORKS EXECUTED UNDER "SPECIAL WORKS" GIVEN IN APPENDIX F.

NAME OF PROJECT.	NAME OF WORK.	C O S T.		
		Per Work.	Total per Project.	Total per Circle.
		L. E.	L. E.	L. E.
	4TH CIRCLE.			
Walidiyah Syphon.	Completing Walidiyah Syphon under Ibrahimiyah Canal...	600	600	
Concession of Asyut Basins.	Pitching	619		
	Room and Store at Baragil	42		
	Three culverts and remodelling Ashmunin Regulator	659		
	Escape tail Canal Arus	100		
	Three road bridges on canals	513		
	Iron and wood work	611	2,544	
Fayum Remodelling.	<i>Canals :</i>			
	Demarcation of land on Canal A. Wahbi — 3rd reach	40		
	52 Masonry works on Bahr Seilah	6,070		
	23 Masonry works on Bahr Serb	7,580		
	Revetment on Seilah system	803		
	Iron work	1,313		
	<i>Drains :</i>			
	Falls below Khazzan Tamiyah	660		
	Masonry works on Seila system	4,420		
	Iron work	445	21,331	24,475
	PROJECTS CIRCLES.			
Southern Minia Basins Conversion.	22 Regulators			
	13 Head Sluices			
	12 Escapes			
	8 Road Bridges			
	7 Syphons	8,212	8,212	
Northern Minia Basins Conversion	26 Regulators			
	78 Head Sluices			
	115 Road Bridges			
	53 Drainage inlets			
	4 Falls			
	17 Syphons	50,037	50,037	
Widening the Ibrahimiyah.	8 Head Sluices	1,095	1,095	
Remodelling Muhit drain.	2 Regulators			
	1 Escape			
	20 Road Bridges			
	2 Railway Bridges	17,805	17,805	77,149
	Grand Total	—	—	101,624

APPENDIX H.

LIST OF NEW AND REMODELLED BANKS AND CHANNELS EXECUTED UNDER
"SPECIAL WORKS" GIVEN IN APPENDIX F.

NAME OF PROJECT.	NAME OF WORK.	Length in kilometres.	Quantity of earthwork.	Cost.	
				Per work.	Total per Project.
			C. M.	L. E.	L. E.
	4th CIRCLE				
Asyut Basins Conversion.	Banks	3,500	18,235		
	Canals	3,565	15,423		
	Drains	15,237	59,278	1,255	1,255
	<i>Canals:</i>				
	2nd Reach A. Wahbi	22,224	1,142,298	15,992	
	3rd " " " " " " " "	17,500	536,226	8,312	
	Bahr Serb system	39,000	486,653	7,300	
	Remodelling Bahr Magatia and branches	18,934	251,333	3,770	
	<i>Drains:</i>				
	Remodelling Bahr Seila and Roda systems	79,478	479,169	7,000	42,374
	Total 4th Circle	199,438	2,988,615	43,629	43,629
	PROJECTS CIRCLE				
Southern Minia Basins Conversion.	New channels	57,250	434,640	8,309	
	Strengthening banks	—	489,544	6,478	14,787
Northern Minia. Basins Conversion.	Canals	310,500	5,154,266	88,795	
	Drains	230,509	595,718	11,021	99,816
Widening the Ibrahimiyah.	Deint to Minia	—	1,115,074	22,121	
	Minia to Matay	—	1,004,900	39,699	
	Matay to Mayana	—	1,040,593	16,895	78,715
Remodelling Muhit drain.	Etsa to Salibah Kom Saaydah and Absug drain	—	2,043,013	36,318	36,318
Etsa Pumping Stations.	Delivery channels	—	27,980	504	504
	Total Projects Circle	—	12,256,728	230,140	230,140
	5th CIRCLE				
Railway diversion Hod Hamed.	Straightening bank	9,604	—	3,630	3,630
Aswan Districts Canals.	Small channels	—	—	370	370
	Total 5th Circle	—	—	4,000	4,000
	Grand Total	—	—	—	277,769

APPENDIX K.

REVTMENT OF BASIN BANKS WITH STONE.

PROVINCE.	LENGTH REVTED.			EXPENDITURE DURING THE YEAR.		
	Previously reported.	Added during 1903.	Total to date.	New Revtment.	Repairs.	Total Expenditure.
	M.	M.	M.	L.E.	L.E.	L.E.
4TH CIRCLE.						
Beni Suef.	40.329	—	40.329	—	—	—
Minia	89.069	1.003	90.072	1,395	337	1,732
Asyut	59.236	—	59.236	—	—	—
Total...	188.634	1.003	189.637	1,395	337	1,732
GIRGA DIRECTORATE.						
Girga	47.253	2.397	49.650	1,219	170	1,389
Asyut 2nd Section. ...	50.203	3.096	53.299	1,632	169	1,801
Total...	97.456	5.493	102.949	2,851	339	3,190
Grand Total...	286.090	6.496	292.586	4,246	676	4,922

APPENDIX M.

STATEMENT SHOWING THE AREA UNDER DIFFERENT CROPS IN UPPER EGYPT, INCLUDING GOVERNMENT AND WAKFS LAND
AND LAND OF THE DAIRA SANIEH AND DOMAINS, FROM SEPTEMBER 1903 TO AUGUST 1904.

NAME OF PROVINCE.	WINTER CROPS.					SUMMER CROPS.					NET CROPS.		Total area of crops.	Waste land "Bour"	Total area taxed or untaxed.	Area double cropped	Area of cultivated land.
	Gardens.	Wheat.	Beans.	Barley.	Other (Crop).	Summer Rice.	Summer Maize.	Cotton.	Sugar Cane.	Other Crops.	Siam and Sham Maize.	Net Rice					
	FED.	FED.	FED.	FED.	FED.	FED.	FED.	FED.	FED.	FED.	FED.	FED.	FED.	FED.	FED.	FED.	FED.
Beni Suef..	256 12	76040 15	63715 16	16450 11	12510 1	—	7116 1	31531 4	1190 19	2019 —	33807 18	6 —	275891 10	5333 16	283228 2	10328 10	212899 16
Fayum ..	3038 11	69137 15	69443 21	27717 11	92612 20	5 —	2 —	38217 18	685 3	7639 22	150624 18	26211 8	510923 5	15303 5	556306 10	2336 10 11	322065 23
Mina ..	522 21	84689 18	93880 15	13759 19	97638 21	—	11206 15	15206 15	27638 1	3319 8	63629 1	—	419623 19	48195 15	198121 10	686 19 5	429472 3
Assut ..	4161 8	112302 3	130836 6	16724 5	112176 6	—	36529 10	11611 1	112321 23	2746 19	11109 8	—	155219 20	18323 9	163813 5	57846 7	135690 22
Girga..	2053 12	100341 15	61628 7	13890 11	88445 11	—	35401 13	70 —	9881 23	1283 10	28340 9	—	571358 22	11732 12	389091 10	56463 15	352545 17
Koha..	1060 1	73270 5	22146 16	85776 11	73620 1	—	22303 11	—	17216 22	1921 11	52713 4	—	350113 23	73722 12	123836 11	50089 23	361546 12
Assuan ..	1189 11	15569 5	3928 11	12622 10	6518 18	—	3529 11	—	86 —	2078 9	23240 11	—	65763 19	16157 18	81901 13	5151 4	76750 9
Total ..	9575	752844 14	8447679 22	212961 9	513522 12	5 —	119918 16	116566 17	63020 22	20401 7	101775 —	26220 8	2503899 20	222128 17	2126028 13	521199 7	2201829 6

APPENDIX S.

TABLE I.—STATEMENT SHOWING THE QUANTITY OF SUGAR-CANE CRUSHED IN THE DAIRA SANIEH FACTORIES IN MIDDLE AND UPPER EGYPT IN SEASON 1903-1904 AND THE AMOUNT OF No. 1 SUGAR PRODUCED.

NAME OF FACTORY.	Cane crushed in kantars.	Outturn of No. 1 Sugar in kantars.
MIDDLE EGYPT.		
Biba	1,495,260	129,016
Maghagha	—	—
Matai	1,974,136	183,002
Minia	—	—
Abu Qirgas	2,372,916	211,957
Roda	—	—
Total, Middle Egypt	5,842,312	523,975
UPPER EGYPT.		
Dabaiyah	—	—
Armant	—	—
Mata'anah	994,307	104,281
Total, Upper Egypt	994,307	104,281
Grand Total	6,836,619	628,256

APPENDIX S—*continued.*

TABLE II.—SUGAR-CANE CRUSHED AND SUGAR OUT-TURNED BY THE DAIRA SANIEH FACTORIES DURING THE LAST TWENTY-FIVE YEARS.

Factory season.	From crop of.	Quantity of cane crushed in kantars.	Total sugar produced in kantars.	Nature of summer level preceding factory season.	REMARKS.
1880	1879	8,402,833	605,623		The total sugar produced includes the three qualities Nos. 1, 2 and 3.
1881	1880	2,365,642	182,096		
1882	1881	7,336,192	603,225		
1883	1882	4,880,094	422,622	Unfavourable.	
1884	1883	8,445,247	667,451	Favourable.	
1885	1884	9,918,201	854,884	Very favourable.	
1886	1885	11,258,057	973,500	Fair.	
1887	1886	10,986,224	934,376	Favourable.	
1888	1887	10,411,640	951,352	Favourable.	
1889	1888	8,382,837	790,197	Fair.	
1890	1889	7,602,302	695,870	Very favourable.	
1891	1890	11,130,799	1,149,893	Very low.	
1892	1891	12,522,918	1,329,627	Low but early rise.	
1893	1892	12,755,107	1,207,164	Low and late rise.	
1894	1893	14,253,813	1,427,608	Very favourable.	
1895	1894	14,601,832	1,385,345	Favourable.	
1896	1895	15,217,050	1,564,972	Very favourable.	
1897	1896	13,253,433	1,882,979	Very favourable.	
1898	1897	12,369,140	1,176,067	Very favourable.	
1899	1898	11,636,689	1,173,871	Low.	
1900	1899	12,680,860	1,340,983	Very favourable.	
1901	1900	9,680,482	1,057,902	Very low but early rise.	
1902	1901	9,649,009	1,081,967	Very low rise early, but feeble.	
1903	1902	9,144,560	944,643	Very low with late and feeble rise.	
1904	1903	—	—	—	

APPENDIX S—*continued.*

TABLE III.—SUGAR-CANE CRUSHED AND SUGAR OUTTURNED IN SULTAN PASHA'S FACTORY AT DAMARIS DURING THE LAST TWENTY-ONE YEARS.

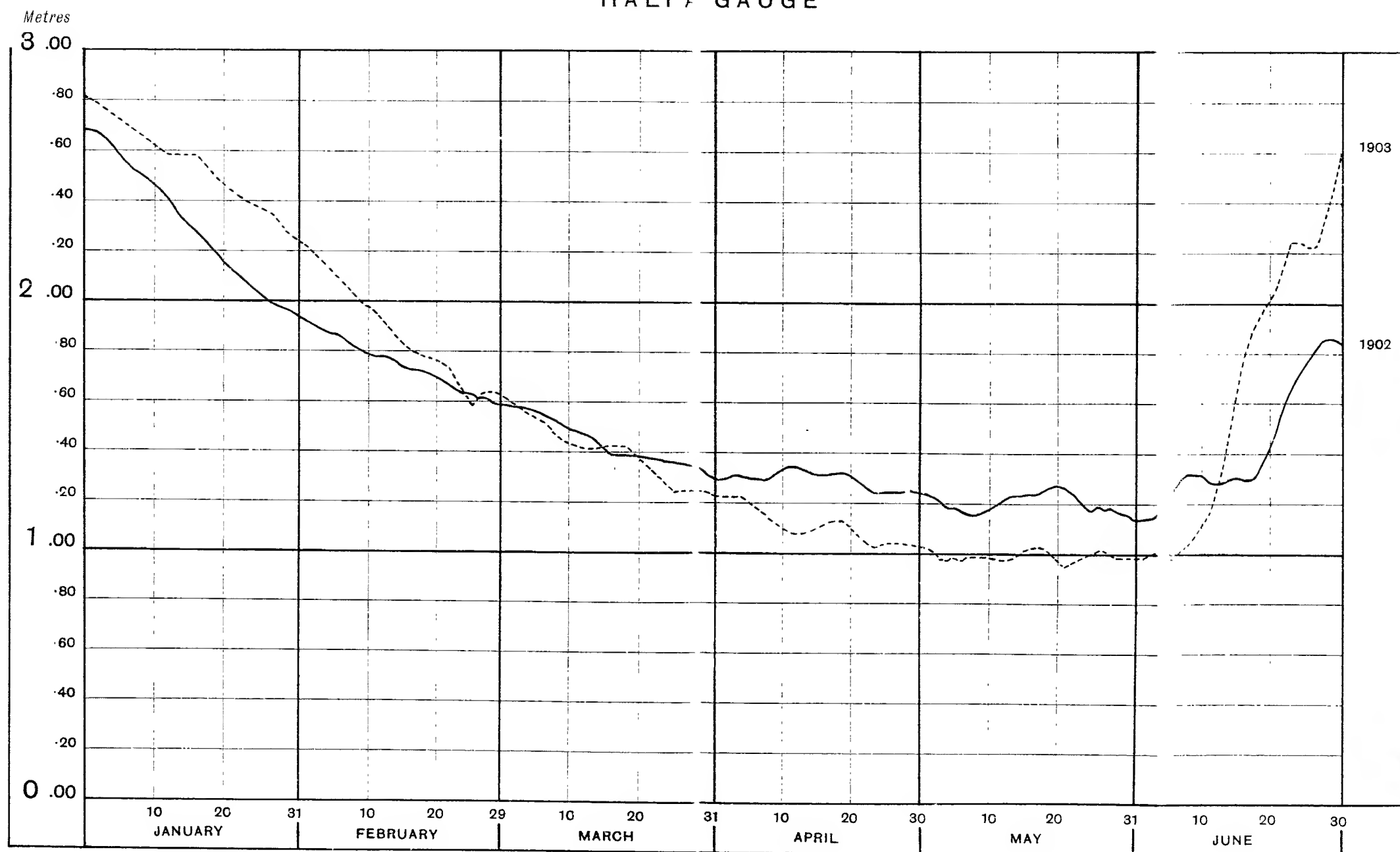
Factory Season.	From crop of	Quantity of cane crushed in kantars.	Total sugar produced in kantars.	REMARKS.
1884	1883	258,855	23,199	The total sugar produced includes the three qualities Nos. 1, 2 and 3.
1885	1884	258,405	24,720	
1886	1885	250,426	23,705	
1887	1886	272,984	23,903	
1888	1887	274,549	23,636	
1889	1888	276,505	24,648	
1890	1889	266,218	23,783	
1891	1890	228,421	31,609	
1892	1891	382,791	36,161	
1893	1892	442,187	37,275	
1894	1893	471,076	40,253	
1895	1894	545,274	47,429	
1896	1895	587,462	59,543	
1897	1896	451,390	40,566	
1898	1897	479,822	48,761	
1899	1898	466,027	46,732	
1900	1899	524,466	54,966	
1901	1900	410,465	44,700	
1902	1901	565,931	52,102	
1903	1902			
1904	1903	384,828	37,099	

APPENDIX S—concluded.

TABLE IV.—STATEMENT SHOWING THE QUANTITY OF SUGAR-CANE CRUSHED IN THE FACTORIES OF THE
 “SOCIÉTÉ GÉNÉRALE DES SUCRERIES DE LA HAUTE-ÉGYPTÉ” AND THE QUANTITY OF NO. 1 SUGAR
 PRODUCED DURING THE PAST SEVEN YEARS.

SEASON.	FACTORIES.							
	Naga Haddi.		Shekh-Fadi.		Hawandiyah.		TOTAL.	
	Cane crushed in kantars.	Outturn of No. 1 Sugar in kantars.	Cane crushed in kantars.	Outturn of No. 1 Sugar in kantars.	Cane crushed in kantars.	Outturn of No. 1 Sugar in kantars.	Cane crushed in kantars.	Outturn of No. 1 Sugar in kantars.
1896-1897	644,438	68,888	1,822,204	191,109	1,333,320	135,554	3,799,962	395,551
1897-1898	1,661,418	108,870	2,782,670	238,574	654,808	56,990	5,098,896	409,434
1898-1899	1,776,825	173,263	3,158,415	304,949	1,315,080	125,790	6,250,320	604,002
1899-1900	1,618,341	168,252	3,169,252	301,191	1,191,278	105,641	5,978,871	575,409
1900-1901	—	—	—	—	—	—	6,908,772	682,587
1901-1902	3,231,460	265,600	3,505,617	283,164	916,471	94,067	7,653,548	* 612,813
1902-1903	3,233,284 833,480	315,977 }	3,487,123 182,289	371,570 }	923,692 94,559	108,038 }	7,644,099 360,688	795,585 }
1903-1904	4,663,863 4,517	484,533 }	2,690,947	274,016	528,019 45,315	62,482 }	7,822,829 49,872	821,031 }

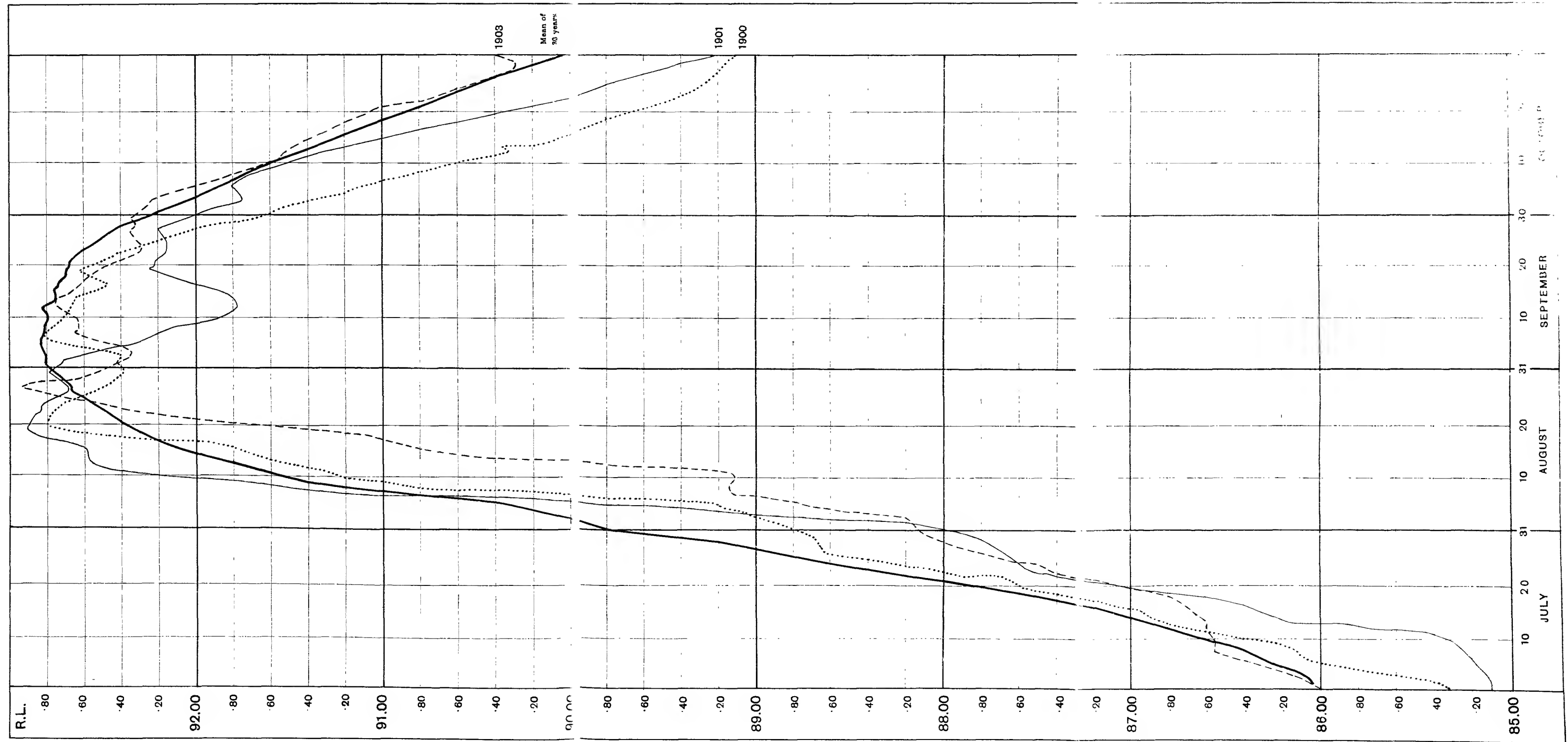
HALF GAUGE

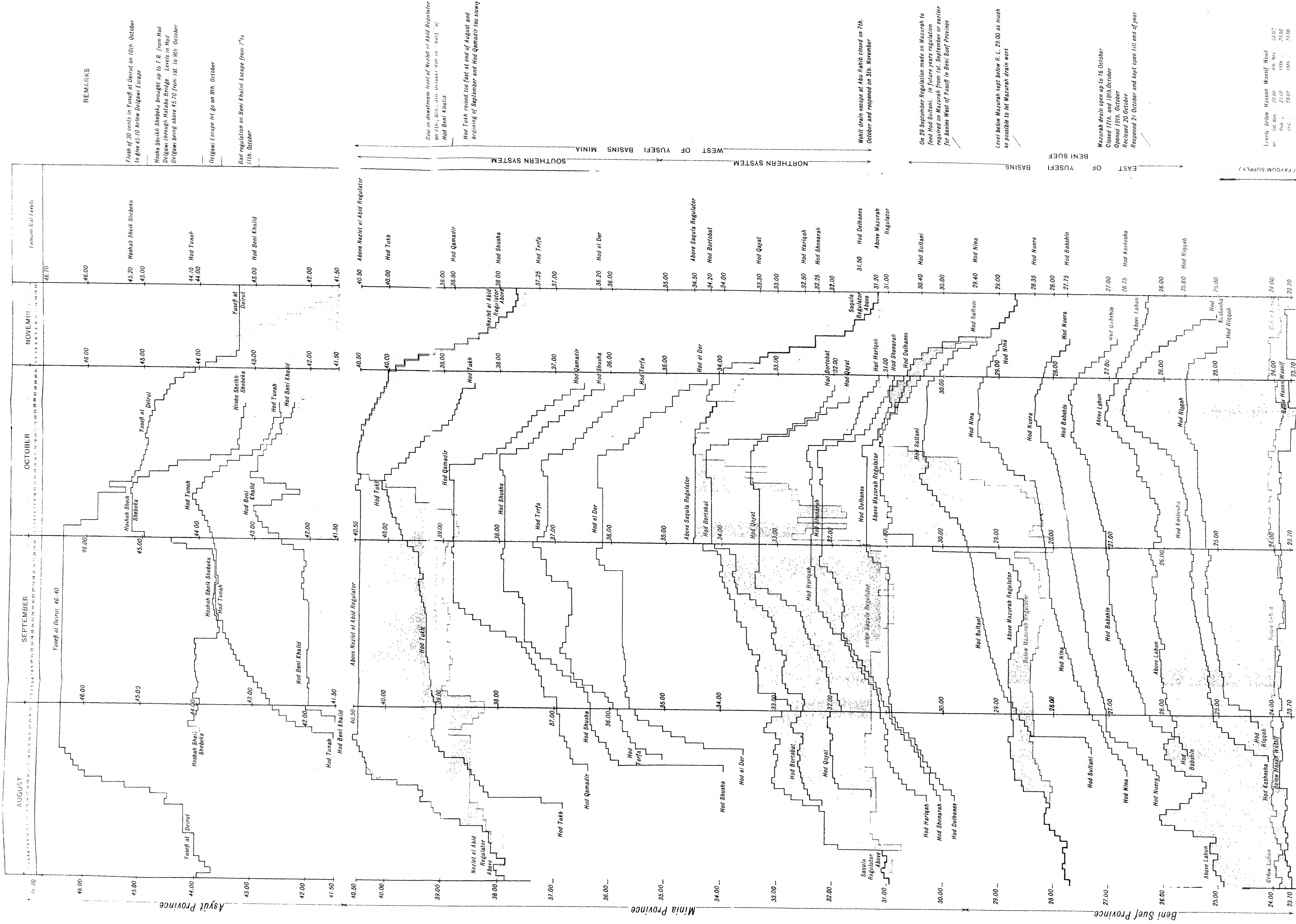


N.B. 1902 levels very low during summer

1903 >> still lower >> >>

ASWAN GAUGE





ADMINISTRATION REPORT
OF THE
IRRIGATION DEPARTMENT IN LOWER EGYPT
For 1903

BY
K. E. VERSCHOYLE,
INSPECTOR GENERAL OF IRRIGATION IN LOWER EGYPT.

TABLE OF CONTENTS.

CHAPTER I.—WINTER, SPRING AND SUMMER IRRIGATION.

	Page.
River levels	117
Sadd Damietta Branch... ..	118
Mehallet El Amir Sadd..	118
Atf pumping station	119
Winter and Spring rotations	119
Supply from Aswan Reservoir	120
Supply reaching Delta Barrages	120
Distribution of supply... ..	121
Sharaki Decree	122
Summer rotations	122
Duty of water	126
Crops... ..	129

CHAPTER II.—FLOOD IRRIGATION.

Flood levels at Delta Barrage	131
Flood rotations	132
Regulation on Zifta Barrage	132
Flood irrigation Gizeh Province	134
Flood watchmen	136
Nile gauges,	136
Lake Victoria gauges	137

CHAPTER III.—DRAINAGE.

Maintenance of drains	138
Rotations on drains,	139
Mex pumping stations... ..	140
Levels of lake Mariotis..	141

CHAPTER IV.—NEW WORKS OF IRRIGATION AND DRAINAGE AND WORKS CHARGED TO SUNDRY CREDITS.

Caisse Credits... ..	142
Irrigation improvements,	144
Zifta Barrage	152
Drainage works,	152
New channels-irrigation and drainage	156
Sundry credits... ..	157
Agricultural roads	157
Ferry bridges	158
Expenditure for Companies and other Administration	158

CHAPTER V.—MAINTENANCE AND REPAIRS.

	Page
Expenditure on maintenance	159
Flood protective works	160
General maintenance	161
Maintenance of canals and drains	162
Dredging	164

CHAPTER VI.—WADI TUMLAT ESTATE.

Capital expenditure... ..	164
Revenue account	165
Crops... ..	166
Kassassin pumping station	166
Estimate for 1904	167

CONCLUSION.

Staff	168
--------------	-----

APPENDICES.

A. Abstract of accounts... ..	171
B. New and remodelled irrigation channels... ..	172
C. New and remodelled drains	173
D. Canals subject to special rotations for rice cultivation... ..	174
E. Statement of areas under different crops... ..	175
F. Note by Mr. Molesworth on Abu Zibel Syphon... ..	176

ADMINISTRATION REPORT OF THE IRRIGATION DEPARTMENT IN LOWER EGYPT FOR 1903.

CHAPTER I.

WINTER, SPRING AND SUMMER IRRIGATION.

RIVER LEVELS.

As the Aswan Reservoir began to withdraw water from the river on the 20th October 1902, the levels on the Aswan gauge after that date cannot be compared with those of previous years. In future the Wady Halfa gauge will be the one used when comparing different years as regards the supply in the river.

The level on the Wady Halfa gauge on the 1st of January 1903 was 2.80, which was 4 centimetres higher than the level on the same date in 1901, 12 centimetres higher than the level on the 1st January 1902, and 86 centimetres higher than the level recorded on the 1st January 1900, the year of minimum recorded summer supply. The mean level for the 1st January on the Wady Halfa gauge for the past 12 years is 3.20, so that judging by this gauge the year did not open with very bright prospects as regards summer supply; in fact the only years on record which started with a lower level at Halfa were 1900, 1901, 1902. The level at Khartoum was, however, slightly more encouraging, being 26 centimetres higher than the levels for the same date in 1900 and 1902, though 10 centimetres below that of 1901.

The level at Khartoum fell steadily up to the 17th May, on which date the gauge reading was 10 centimetres lower than on the same date in the minimum year of 1900.

The rise commenced in a very satisfactory manner, so that by the 25th May the levels of the three previous years were surpassed at Khartoum, and the level of 1899, a year of good summer supply, was passed on the 29th May. The rise continued satisfactory up to the 18th June when a check, ending in a slight fall, occurred. By the end of May it was evident that the supply above the Delta Barrages might, irrespective of the reservoir supply, be expected to improve by the end

of June, and, with the aid of the reservoir supply at an early date in June, create a very happy state of affairs as compared with any previous year.

SADDS IN THE ROSETTA AND DAMIETTA BRANCHES OF THE NILE.

In anticipation of the assistance from the Aswan Reservoir, it was decided not to make the Faraskour Sudd in the Damietta Branch which had been made in 1900, 1901 and 1902.

In order to maintain the level above the sudd in 1902, it was found necessary to pass water into the river at Mansurah during May and the first half of June, and again from 12th July, and also to pass a small discharge through the Delta Barrage. The gross cube so passed into the river from April to July, was, as near as I can estimate on the data available, about 86,000,000 cubic metres, meanwhile, the 68 river pumps north of Mansurah were raising water at the rate of 1,356,000 cubic metres per day, *i.e.*, they raised a total cube of 165,000,000 cubic metres between the beginning of April and end of July. Deducting the amount passed into the river at the Delta Barrage and Mansurah, which could otherwise have been utilized in the canals, we are left with 79,000,000 cubic metres as the amount of water derived from the pool above the sudd from the date of its closure up to the end of July. None of this cube would have been available without the sudd, as only the cube raised by the pumps north of Mansurah has been taken into account.

This cube of 79 millions would have sufficed to give 6 waterings to an area of 33,000 feddans of ordinary crops. The cost of the sudd was L.E. 5,000 which comes to P.T. 15 per feddan of irrigated area.

It appears from the above that, if the figures for the cube passed into the Damietta Branch are approximatively correct, there is a good deal to be said in favour of constructing this sudd, especially if it be decided not to feed the Rayyah Abbas and Mansuria Canals from above Zifta Barrage in the summer.

MEHALLET EL AMIR SADD.

The Mehallet El Amir Sudd on the Damietta Branch was made for the fourth year in succession at a cost of L.E. 7,871. The sudd was commenced on 28th January and finally closed on the 20th May. A breach, which occurred in the portion crossing the deep channel on the east bank on 9th April, delayed the closure considerably.

The sudd was made with a crest level of 3.25 to hold up water to R.L. 2.50.

The volume of water withdrawn from the pool above the sadd is estimated as follows:—

	Cubic metres.
By the 2nd Circle Canals	39,281,500
By the Rosetta Canal Behera	13,169,421
By Atf pumps	15,393,618
By private pumps	7,000,000
Total	<u>74,844,039</u>

The sadd was cut on the 21st July.

The cube of 74,844,039 cubic metres would suffice to give three waterings to an ordinary crop of 62,370 feddans between the 20th May and end of July. The cost of the sadd being L.E. 7,871 the cost of irrigation per feddan works out to P.T. 13. It is well worth spending L.E. 7,871 to assure the crops and taxes on an area of 62,370 feddans.

ATF PUMPING STATION.

It was only found necessary to work the Atf wheels for 22 days between the 6th May and 15th July. The expenditure on the station was as follows:—

	L.E.
Establishment and maintenance charged to Regular Budget	450
Working pumps charged to Low Nile Credit	725
Contribution from Kom El Akhdar Estate towards working of pumps	176
Total	<u>L.E. 1,351</u>

WINTER AND SPRING ROTATIONS.

The supply during the winter was ample for all demands. A good deal of attention has latterly been paid to the important subject of regulation at all seasons, with the object of producing levels for limited periods sufficient for flow irrigation wherever that may be possible. This is a boon much appreciated by the cultivators as the saving thereby effected in cost of fuel and wear of cattle is very great. An adequate provision of regulators is of course the first requisite towards making the system general. Thanks to the funds granted by the Caisse de la Dette for irrigation improvements, a good many regulators have been built during the past few years. This system of scientific and systematic regulation is most advanced in the 2nd Circle in which tables indicating the periods of high and low supply and the levels above and below regulators to be worked to, have been drawn up.

During the winter and spring 4 days of high, followed by 12 to 16 days, according to the time of year, of low supply is given. The Inspector of Irrigation 2nd Circle notes that it was found possible, during the past year, to continue this system up to the middle of April after which the general working of lift machines made it impossible to keep up levels. A month of unrestricted irrigation with low levels then followed till replaced by the usual summer rotations.

SUPPLY FROM ASWAN RESERVOIR.

It had been originally intended to indent on Aswan Reservoir for Lower Egypt as follows :—

									Cubic metres per day.
From	1st May	to	20th May	...	...	...	...	...	2,000,000
"	21st "	to	25th "	...	...	...	...	...	5,000,000
"	26th "	to	9th June	...	...	...	...	...	7,000,000
"	10th June	to	27th "	...	...	...	...	...	10,000,000
"	20th "	to	7th July	...	...	...	...	...	10,000,000

The early rise at Khartoum, however, rendered it possible to modify the programme so as to complete the emptying of the Reservoir at an earlier date, and the programme worked to was as follows:—

	Water drawn from Reservoir for Lower Egypt.
From 1st to 20th May	2,000,000 cubic metres per day.
" 21st May to 25th May	7,000,000 "
" 26th May to 3rd June	9,000,000 "
" 4th June to 24th June	15,000,000 "

The rise began to reach Aswan on the 17th June.

SUPPLY REACHING DELTA BARRAGES.

The Delta Barrages were tightly closed from the 10th April. The supply reaching them continued to diminish up till the 1st of June when the canals upstream of the barrages were drawing an aggregate discharge of 31,780,000 cubic metres per day. By the 8th June the discharge had increased to 36,220,000 cubic metres per day, under the influence of the discharge let go from the Aswan Reservoir on the 21st May. From the 10th June, or 16 days subsequent to the date that a discharge of 9 millions per day began to be sent down from the

Reservoir for Lower Egypt, the discharge above the barrages began to increase rapidly and had reached 41,440,000 cubic metres per day by the 15th June. The level of 15·50, the maximum level to which water is held up on the barrages without allowing any water to pass through them, was reached on the 3rd of July. The same level was not reached in 1900 till the 2nd of August, in 1901 till the 22nd July, and in 1898 and 1899, before the new weirs below the barrages began to work, till the 12th and 31st August respectively. Had it not been for the Aswan Reservoir, no improvement in the supply for the Delta could have been expected before the 2nd or 3rd of July, and then it would have been much slower than was the case with the reservoir to draw on.

The construction of the Barrage weirs had the effect of reducing the time of tension, as regards supply in the Delta, by from three weeks to a month. The effect of the Aswan Reservoir, combined with an early and satisfactory rise in the river, during the summer of 1903, was to reduce the time of tension by about another month, so that the period of very short supply was reduced to 38 days or from 1st May to the 8th June. In 1898, 1899 and 1900 the periods of tension or very short supply were 92 days, 70 days and 113 days respectively.

This reduction in the length of the period of tension, which increased in intensity the longer it grew, has been an enormous relief to the Irrigation staff, which has no longer to devote its entire energy for three months of the year to the question of distribution of water, much to the benefit of general administration.

DISTRIBUTION OF SUPPLY.

Following the practice of the previous year the discharge reaching the Delta Barrages was distributed as follows:—

1st Circle	43 %
2nd Circle	34 %
3rd Circle	23 %

The following table shows a few of the weekly discharges observed, and compares them with the correct discharges worked out in accordance with the above basis of distribution;—

DATE	1ST CIRCLE		2ND CIRCLE		3RD CIRCLE	
	Measured Discharge.	Correct Discharge	Measured Discharge.	Correct Discharge.	Measured Discharge.	Correct Discharge.
15th April ...	17,611,875	17,135,500	13,973,602	13,539,000	8,362,665	9,165,500
1st May ...	15,876,302	16,249,700	13,399,600	12,848,600	8,512,931	8,691,700
15th May ...	13,444,997	13,824,500	12,012,944	10,931,000	6,695,723	7,394,500
1st June ...	14,294,256	13,669,730	10,376,225	10,808,620	7,119,074	7,311,700
15th June ...	17,339,002	17,823,500	15,614,986	14,093,000	8,494,519	9,533,500
23rd June ...	19,959,663	19,482,952	15,759,516	15,405,125	9,590,011	10,421,114

The table shows that the 2nd Circle came off somewhat the best at the expense of the 3rd Circle. This was due to the fact that the discharges of the Rayah Menafia gave steadily higher results for the same gauge readings than the discharge curve based on the previous years series of observed discharges.

SHARAKI DECREE.

The decree prohibiting the irrigation of fallow land until a date to be notified was issued on the 19th May 1903 to take effect from the 26th May 1903. The prohibition was removed on the 1st July when the level upstream of the Delta Barrage had almost reached 15.50.

SUMMER ROTATIONS.

Summer rotations commenced on the 15th May. They might with advantage have been commenced a fortnight earlier, as there was a considerable shortness of supply in some localities during this period.

The first table of rotations allowed for 6 days watering and 12 days stoppage for ordinary crops. For canals and sections of canals serving rice districts the rotation programme of the 1st Circle allowed for 4 days watering followed by 6 days stoppage, and those of the 2nd and 3rd Circles for 4 days watering followed by 5 days stoppage. The reason of the difference is that experience has shown that in the tangled system of long channels in the rice districts of Sharkia and Dakahlia it is impossible to get the rotations to work satisfactorily without the introduction of a day of general stoppage following the working turn of any section, so as to allow of the next section filling up throughout its length before the withdrawal of water commences. A notification was published in the "Official Journal" of 23rd March indicating the canals and sections of canals for which the rotation

programmes would be framed to allow of rice cultivation; a copy of this notification will be found in appendix D. The channels and sections of channels included in the notification practically allowed of rice cultivation over the whole area where it is ordinarily practised.

In appendix D will be found an interesting plan of the 1st Circle showing how the area was divided off into blocks for the purposes of rotations. The programme commenced by the stoppage of sections A, B, D, while C and E worked, after which came the turn of A and D and so on.

It was intended to apply the above programme for two complete rounds, *i.e.*, from the 15th May to 19th June. It was, however, soon apparent that a programme allowing one watering in 18 days was too liberal. Taking the area given by the Ministry of Finance for the summer crop of 1902, and counting each acre under rice as equivalent to two acres under ordinary crop, we arrive at an area of ordinary crop of 1,446,000 feddans. Now on page 169 of last year's report, Sir Hanbury Brown showed that the amount of water required at the head of the Delta to give one watering to a feddan of ordinary summer crop was 555 cubic metres. If we accept the reasonable figure, given in "Egyptian Irrigation" (Willecks), of 350 cubic metres as the actual amount of water required to give a watering to a feddan of summer crop, it follows that in the Delta 64 % of the head discharge on the average, is actually delivered on to the land. Compared with the results obtained in America and India, this is a very high percentage of which the apparent explanation is to be found in the small loss due to absorption, owing to a retentive soil, and probably still more to the efficient manner in which the fine Nile deposit puddles the irrigation channels throughout their length.

Now if each feddan requires 555 cubic metres and it be desired to give one watering in 18 days, the daily discharge required at the head of the Delta per feddan of ordinary crop becomes $555/18=30.8$ cubic metres. The discharge then required in the river at the head of the Delta to have admitted of an 18-day rotation in 1902 would have been $1,446,000 \times 30.8=44,536,800$ cubic metres, and to have justified the adoption of an 18-day rotation in 1903: at least this amount of water should have been in sight during May and June. Now the discharge available on the 15th April, allowing for 2,500,000 cubic metres in the river below the Barrage, was only 41,448,000 and it was pretty certain to diminish till the 1st week in June, even with the aid of the reservoir water. Hence the decision to draw up the rotation programmes so as to allow of one watering in

18 days cannot be regarded as a prudent one and the results obtained indicate the necessity of proceeding with greater caution in the future.

On the 15th May the available supply had fallen to 36,500,000 c.m. per day and by the end of the month to 34,300,000 c.m. per day. Before the latter date it had become evident that an 18-day rotation was not workable. The crop returns since received show that we were dealing with an ordinary crop of 1,539,000 feddans instead of 1,446,000 feddans, the figure used in the above calculations, which did not improve matters.

Under the circumstances it was decided, on the completion of the 1st round, to stiffen the rotation by introducing 2 days of general stoppage between the 6-day periods of working which makes a rotation period of 24 days. In the rice districts of the 3rd Circle an extra day was added to the time of stoppage, making a rotation period of 10 days the same as that adopted by the 1st Circle in the original programme. The rotation periods for rice canals remained unaltered in the 1st and 2nd Circles. These programmes which, calculating as before, only required a river discharge of 35,397,000 c.m. was immediately effective. These days of general stoppage afford a means of compensating portions of sections which fail to get their full turn, and are most useful in preventing the collapse of the programme when dealing with a barely sufficient supply. As the supply increases and a little more water than required for one section becomes available, they can be omitted.

As noted above the supply began to increase rapidly from the 8th June, the discharge available on the 15th June being 44,900,000 c.m. and on the 23rd June 48,800,000 c.m. It was, therefore, found possible to gradually replace the 24 days rotation by others of much less severity. It appears that, had a start been made with two rounds of a 24-day rotation starting in the 1st of May, the conditions of supply would have been satisfied and the programme would have worked smoothly. As explained at the beginning of this chapter, the early summer supply was a very poor one, and in normal years, under existing conditions a 21-day rotation will probably be found to work satisfactorily.

The following table shows the nature of the rotations actually enforced, and the time each lasted;—

SUMMER ROTATIONS LOWER EGYPT 1903.

Circle.	Period of enforcement.	NATURE OF ROTATION.					
		On canals irrigating ordinary summer crops.			On canals irrigating ordinary summer crops, etc.		
		Number of days working.	Number of days stoppage.	Frequency of waterings.	Number of days working.	Number of days stoppage.	Possible frequency of water.
1st	15th May to 1st June	6	12	18	4	6	10
"	2nd June to 25th June	6	18	24	—	—	—
"	26th June to 21st July	10	8	18	—	—	—
2nd	15th May to 1st June	6	12	18	4	5	9
"	2nd June to 25th June	6	18	24	—	—	—
"	26th June to 2nd July	6	12	18	—	—	—
3rd	15th May to 1st June	6	12	18	4	5	9
"	2nd June to 25th June	7½	16½	24	—	—	—
"	26th June to 5th July	10	8	18	—	—	—

Rotations were removed on the following dates:—

In the 1st Circle... On 4th July in Kalioubia Province and on 21st July in Sharkia and Dakahlia Provinces.

In the 2nd Circle... On the 3rd July.

In the 3rd Circle... On the 5th July.

Results showed that it would have been better to maintain a mild rotation for another three weeks in the 2nd and 3rd Circles, as with the removal of the Sharaki Decree on the 1st July the demand, as usual, went up with a bound and notwithstanding the fact that the aggregate discharge of the canals on the 8th July had reached 71,000,000 c.m. per day, difficulties were experienced in getting water to the tail reaches well into July, and free flow levels were late in coming to sections of canals in which with a mild rotation they could easily have been induced at an earlier date. The moral is that rotations should be removed very gradually by gradually reducing the length of periods of stoppage. Mr. Dupuis, Inspector of the 2nd Circle, makes the following remarks in this connection:

"On the removal of restrictions all pumps and lifting machines worked their hardest irrigating Sharaki, with the result that canals running full flood supplies at their heads were pumped absolutely dry in their lower reaches, and hardly anywhere was the irrigation effected by free flow,

many proprietors having to pay a heavy tax (generally P.T. 50 per feddan) to the pump-owners for the irrigation of their Sharaki lands. Had it been possible to stop all water lifting, it would have made practically no difference to the canal discharges, which would have irrigated the same area of land in the same time by free flow, and much useless expense would have been avoided. A mild rotation with overlapping turns would have met the case fairly well, as the smaller number of machines working would have been unable to keep down the canals, which would have risen and flowed on to the land through the outlets."

DUTY OF WATER.

The natural period on which to calculate the duty obtained from the available supply during the summer would appear to be that included between the dates of the commencement of summer rotations, and the removal of the Sharaki Decree. The imposition of rotations implies that supply no longer equals demand and that efforts are being made to extract the highest possible duty from the water. On the removal of the Sharaki Decree summer, flood, and winter irrigation becomes simultaneous and the calculation of a water duty becomes impossible. We thus arrive at the 46 days, included between the 15th May and the 30th June, as the period on which to work out the summer water duty for 1903.

The mean discharges of the main canals worked out as usual on the mean gauge readings for this period of 46 days were as follows:—

CANAL.	Mean W.L.	Corresponding discharge.
	R.L.	c.m.
Rayyah Behera	13.78	7,700,000
Rayyah Menufia	13.82	12,800,000
Rayyah Tawfikî	13.44	10,200,000
Canal Ismailia	14.13	3,000,000
Canal Sharkawia	14.15	2,000,000
Canal Basusia	14.10	950,000
Total representing mean discharge withdrawn by canal above the Delta Barrage between 15th May and 30 June		36,650,000

The areas under summer crops in 1903 as furnished by the Ministry of Finance are as follows:—

CIRCLE.	Summer Rice.	Cotton and Summer Crops other than rice.
	Feddans.	Feddans.
1st Circle	56,893	534,095
2nd	26,872	491,724
3rd .,	41,843	261,098
Total	125,608	1,286,917

The supply of water available for irrigation during the selected period of 46 days is as follows:—

	C. m. per day
Total discharge of 6 canals	36,650,000
Lifted by River Pumps below the Barrages	2,500,000
Taken from Mehallet El Amir Pool	816,000
Total	39,966,000
Deduct for Alexandria	45,000
Deduct for Port Said and Suez	100,000
	145,000
Available for Irrigation	39,821,000

Assuming, as done in last year's report, that rice takes double the amount of water that other summer crops do, the general duty is arrived at as follows:—

$$\frac{\text{Total available supply } 39,821,000}{125,608 \times 2 + 1,286,917} = \frac{39,821,000}{1,538,133} = 25.9 \text{ c.m.}$$

a feddan of rice would thus require 51.8 cubic metres per day, and a feddan of other summer crops 25.9 cubic metres per day. Both the Inspectors of the 1st and 3rd Circles agree in considering the areas furnished by the Ministry of Finance as considerably below the mark, especially as regards the area under summer rice. The Inspector of Irrigation, 1st Circle, estimates the area under rice in his Circle at 78,270 feddans, against 56,893 feddans given in the statement supplied by the Ministry of Finance. With such uncertainty as to the correct areas under crop, figures for water duty must be accepted with the utmost reserve. On all sides in the northern Delta freshly reclaimed land under crop is to be seen, which leads to the belief that there must be a steady increase in the cropped area.

The following are the calculations for the summer water duty worked out for each Circle separately:—

DUTY OF WATER—1ST CIRCLE.

The areas under crop were:—

	Feddans.
Summer rice	56,893
Cotton and other summer crops	534,095

Doubling the rice area and adding the product to the area of other crops we get 647,881 feddans.

The mean summer discharges were:—

	Cubic metres per day.
Rayyah Tewfiki	10,200,000
Canal Ismailia	3,000,000
Canal Sharkawia	2,000,000
Canal Basusia	950,000
River pumps	500,000
Total	16,650,000
Deduct for Port Said and Suez	100,000
Total available supply	16,550,000

The general duty is, therefore, $\frac{16,550,000}{647,881} = 25.5$ cubic metres.

DUTY OF WATER—2ND CIRCLE.

The areas under crop were:—

	Feddans.
Summer rice... ..	26,872
Cotton and other summer crops	491,724

The available supply was:—

	Cubic metres per day
Rayyah Menutia	12,800,000
River pumps	1,500,000
Drawn from Mehallet El Emir Pool	666,000
Total discharge available	14,966,000

The general duty is, therefore, $\frac{14,966,000}{26,872 \times 2 + 491,724} = 27.4$ cubic metres.

DUTY OF WATER—3RD CIRCLE.

The areas under crop were:—

	Feddans
Summer rice	41,843
Cotton and other summer crops	261,098

The available supply was:—

	Cubic metres per day.
Rayyah Behera	7,700,000
River pumps and Mehallet El Emir Pool... ..	900,000
	<hr/> 8,600,000
Deduct for Alexandria water supply	15,000
	<hr/> 8,585,000
Total discharge available	<hr/> <hr/> 8,555,000

The general duty is, therefore, $\frac{8,555,000}{41,843 \times 2 + 261,098} = 24.8$ cubic metres.

The following table compares the above results:—

	General duty	Rice duty
Lower Egypt as a whole	25.9	51.80
1st Circle	25.5	51.00
2nd	27.40	54.80
3rd	24.80	49.60

As noted before, the 3rd Circle got slightly less than its share (based on the crop figures of 1901) of the discharge at the Delta Barrage, but this fact only accounts for a portion of the difference in its general duty as compared with the other Circles, which is also largely due to the fact that its rice area has quadrupled since 1901, while the 1st and 2nd Circles only show increases of 80% and 90% in their rice areas when compared with the same year. The result is that the area used in calculating the general duty for 1903 in the 3rd Circle has increased by 25% as compared with 1901, while in the same time, the areas used for calculating the general duty in the 1st and 2nd Circles have only increased by 7% and 4½% respectively. The proportions allotted to the several Circles will have to be recast in the light of the above facts.

The yield of the cotton crops will probably reach 6,500,000 kantars. The arrivals at Alexandria up to the 31st May have been 6,276,283 kantars against 5,659,785 kantars for the same date in 1902. The total

of the crop for 1902, which is taken as the arrivals reported up to the 31st August, was 5,838,790 kantars, so a further receipt of about 250,000 kantars before the 31st August 1904 may be expected, probably more as the cotton has been coming in faster than during the same period last year. The crop, therefore, has only been surpassed by the 1897 crop of 6,566,487 kantars. The area under cotton is given as follows :—

	Feddans.
Upper Egypt... ..	146,367
Lower Egypt... ..	1,186,143
Total... ..	<u>1,332,510</u>

Assuming a crop of 6,500,000 kantars this gives a yield of 4.87 kantars per feddan. By comparing this yield with the figures in the table, on page 163 of last year's report, showing the estimated yields per feddan in Lower Egypt since 1894, it would appear that it is slightly over the average. Now in November it was generally stated that the yield was from 15 to 20% below the average, the reason given being the low temperature which was obtained during the summer. A mild autumn with few fogs had, however, in some degree compensated for the want of summer heat. It is rare to hear of a favourable cotton season. Cold summers, foggy autumns and short water supply being in turn advanced as reasons for anticipating short yields, so no great reliance is to be placed on these rumours. However, the reports of short yield were so persistent last autumn that it seems reasonable to suppose that the yield was actually rather under than over the average and to look for the explanation of the almost bumper crop in increased area, and this is probably the correct explanation.

With rotations greatly relaxed before the end of June, and removed altogether early in July, it is impossible to say that the crop suffered from short supply. In fact some there are who assert that it suffered from a plethora of water. Before the advent of the Delta Barrage weirs the period of greatest trial for the summer crops was from the middle of July to the middle of August. In the past year the water supply during this period was unrestricted. Unfavourable climatic conditions may have affected the out turn, but, as noted above, nearly every crop is said to suffer from unfavourable climatic conditions.

Comparing the estimated outturn with the outturn of 6,369,911 kantars in 1901, a year of short supply and severe rotations, I think the conclusion to be deduced is that a relaxation of rotations and consequent

lower water duty is not likely to yield as good results as the maintenance of a fairly severe rotation, such as one with a 21-day period, and consequent greater economy of water resulting in larger areas.

Appendix E gives the statement of crop furnished by the Ministry of Finance.

Below are compared the areas under crop in 1902 and 1903:—

YEAR.	WINTER CROPS.		SUMMER CROPS.		MILL CROPS.		GARDENS.
	The Delta.	Gizeh.	The Delta.	Gizeh.	The Delta.	Gizeh.	
1902.. ...	2,067,039	136,646	1,366,009	15,820	1,184,635	31,200	11,235
1903.. ...	2,051,977	131,476	1,412,537	44,664	1,119,004	29,245	12,348

As noted before, in the case of the rice crop, the areas are probably under-estimated. The early removal of the Sharaki Decree and the abundant supply in July gave the dhourra crop a chance it has not had for years, and the crop was a plentiful one.

The areas actually under cultivation are given as follows :—

YEAR.	The Delta.	Gizeh.	Total.
1902... ..	3,070,789	180,986	3,251,775
1903... ..	3,069,214	172,100	3,241,314

The difference exists in Gizeh Province in which the uncultivated area is now returned as 28,159 feddans against 11,753 feddans last year.

CHAPTER II.

FLOOD IRRIGATION.

As noted before, the early rise, which resulted in good summer levels at the Delta Barrage in June, was followed by a check and the flood was a late one, and very similar to those of 1900 and 1901. After the level of 15.50 was reached upstream of the Delta Barrage, the usual procedure of allowing the level downstream to rise 4 centi-

metres for each rise of 1 centimetre upstream was followed. The levels thus attained were as follows:—

DATE										LEVEL UPSTREAM OF ROSETTA BARRAGE
July 3rd	...	...	...	...	...	...	...	...	...	15.50
August 10th	...	...	...	...	...	...	...	...	...	15.50
" 15th	...	...	...	...	...	...	...	...	...	15.62
" 20th	...	...	...	...	...	...	...	...	...	15.97
" 31st	...	...	...	...	...	...	...	...	...	16.43

The Barrage was fully open by the end of August by which date the canals were all drawing their full flood supplies. The level upstream of the Barrage fluctuated between 16.20 and 16.50 during September, and rose again under the influence of the discharge from the Upper Egypt basins till it touched 16.93 on 25th October.

FLOOD ROTATIONS.

Flood rotations, which mean regulation so as to give alternate periods of high and low supply in each distributary, or each reach of the main and branch canals, commenced in August. These rotations vary slightly according to circumstances in each circle. In the 2nd Circle they commenced with alternate periods of high and low levels of 7 days each, and in October were modified so as to give 5 days of high and ten days of low levels. The advantages gained by these rotations are increase of flow irrigation and improvement of drainage.

REGULATION ON ZIFTA BARRAGE.

Zifta Barrage, which had been inaugurated in March, was regulated on throughout the summer, and yielded small supplies in the Rayah Abbas for short intervals, during the periods when the operations of rotations caused the level at its junction with the Bahr Shihin to fall sufficiently to create a draw through it. On the 7th July water began to reach Zifta from the Delta Barrage, which begins to pass forward water as soon as an upstream level of 15.50 is reached.

As the rise of the flood was slow, it was seen that some time must elapse before the Damietta branch would fill up sufficiently to feed the Rayah Abbas, without subjecting the new barrage to an excessive head, unless the small earthen saddle, which had been constructed below the latter at the beginning of the summer, were maintained. It was, therefore, decided only to pass such a discharge down the Damietta branch as the Rayah Abbas could dispose of, no water being allowed

to pass forward to wash away the small sadd referred to, till such time as it was possible to pass forward a supply heavy enough to fill the Damietta branch sufficiently to render the sadd unnecessary. This procedure was followed between the 3rd July and 14th August from which date the discharge reaching the Delta Barrages began to increase rapidly, and the river branches began to fill up. The Rayah Abbas began to draw a flood supply on the 14th July with a level up stream of the Barrage of 7.46. The maximum level reached before the down stream sadd disappeared, on 14th of August, was 8.60. The Barrage was fully open on the 30th August, when the upstream level reached 9.0. The maximum upstream level reached in September was 9.42, and in October 9.84. The Rayah Abbas continued to work up till the 15th October, from which date the supply coming down the Rayah Menafia was sufficient for the needs of Gharbia, and it was considered preferable to draw all the supply through the latter in order to maintain levels in it high, so as to afford as much flow irrigation as possible.

The discharge drawn by the Rayah Abbas from the 14th July to the end of August varied from $7\frac{1}{2}$ to $8\frac{1}{2}$ million cubic metres per day. The supply drawn by the Rayah Menafia from the 8th July up to the 15th August was almost constant at 25,000,000 c.m. per day. From the 15th August it began to increase till it reached its maximum of 33,761,000 c.m. on 22nd September. The level in the Rayah Abbas was reduced on the 1st September as the Rayah Menafia was then giving nearly all the supply required. The effect of the Zifta Barrage combined with the Rayah Abbas was, therefore, to increase the flood supply of the 2nd Circle by 30% during the latter half of July and August. This was a great boon rendering the early abandonment of rotations possible, and affording water for early sowings of dhourra and rice.

On the east of the river the new Mansuria Head was not completed. The old head began to draw water from the 19th July, but was closed again, owing to insufficient level between the 5th and 16th August. The Barrage was fully opened by the 31st August so the Mansuria canal, owing to the existence of the Zifta Barrage, drew a flood supply for 31 days during July and August.

The experience of the past season has, I think, shown that to obtain the full duty from the new barrage, a permanent weir is required down stream, so that the moment water is passed forward from the Delta Barrage it can be held up at Zifta to a level of 8.60 and passed into the canals on each bank. There is no navigation in the Damietta branch south of Cherbine during the summer, and a weir with automatic

shutters designed to fall when a depth of say 50 centimetres was passing over them suggests itself. This would ensure a level downstream of the barrage when the shutters fell, sufficient to prevent an excessive head, while maintaining a sufficiently high level above the Barrage to serve the Mansuria canal and Rayah Abbas.

BASIN AND FLOOD IRRIGATION WEST GIZEH.

Water entered the Girza head of the Lebani canal on the 6th August, and Shabramant basin, through Abu Nimros escape, on 13th August. The Giza canal head at Kafr Almar began to draw on the 15th August, and the Zamr canal on 16th August. The level at Maarqab regulator reached 23.10 on 30th August and was held at that till 3rd October. The level at Tama regulator reached 22.20 on 29th August and was held at that till 5th October. The level at Dashur regulator reached 21.80 on 3rd September and was held at that till 8th October. Saqqara regulator was kept tight shut till the 4th September, when the level had reached 20.80. Shabramant Manshia and Iswid basins continued to draw water through Abu Nimros escape till 15th September, when the escape ceasing to draw was closed. Tamam Rai levels were reached on the following dates :—

BASIN								DATE OF REACHING T.R. LEVEL.
Maarqab	...	...	...	...	...	...	...	24th October.
Tama	...	...	...	...	...	...	...	2nd November.
Dashur...	...	...	...	...	...	...	...	30th October.
Saqqara...	...	...	...	...	...	...	...	29th "
Shabramant...	...	...	...	...	...	...	...	15th "
Manshia...	...	...	...	...	...	...	...	30th "
Iswid	...	...	...	...	...	...	...	8th November.
All hoshahs	...	...	...	...	...	...	...	Between 31st October and 10th November.

Water was drawn through Komi regulator between 22nd October and 8th November, when the heads of the Girza and Giza canals were closed, the basins brought up to T.R. levels and the hoshahs along the Giza canal flooded. It will thus be seen that all the basins drew the great bulk of their water directly from the river, only a little topping up of basins being done with the sarf water from Beni Suef, a matter for congratulation.

BASIN AND FLOOD IRRIGATION EAST GIZEH.

Water entered Khashab canal on the 12th August and the Ghamaza head, which feeds the lower reaches of the same canal below Ghamaza regulator, on the 19th August. The Ghamaza regulator was kept

tightly closed till the end of October, when it was opened to complete the filling of the lower basins. The Kafr Tarkhan and Hagir canals, which take off above Ghamaza regulator, began to work on the 18th August. On the 10th September Ghamaza escape, upstream of the regulator, was partially opened to create a draw through the upper basins. This draw was kept up till 10th of October, which was very satisfactory. The Ghamaza feeder worked till the end of October, when the regulator above it was opened. Turah feeder (Maasara basin) and Der-el-Tin escape (Basateen basin) each drew in water for a few days in August. All the basins were filled in good time and kept at T.R. levels, or close to them, for from ten days to three weeks. The date on which T.R. levels was reached in each basin is given below.

BASIN	DATE OF REACHING T.R. LEVEL.
Soul... ..	8th November (level reached 25.33 or 7 below T.R. level)
Atfilh... ..	21st September
Saff... ..	12th October
Aqwaz... ..	12th "
Saadi... ..	6th November
Tabeen... ..	6th October

The improved section in the head reach of the Khashab canal proved of great service and east Gizeh enjoyed better flood irrigation than it has done since the high flood of 1898. The only Sharaki area in the Province was a plot of 300 feddans in the Geziret El-Soul opposite Wasta.

SARE.

Nikla sadd was cut on the 9th November, a month earlier than in 1902, and the drainage of Iswid basin completed by the 17th idem. Girza head and Giza head, at Kafr El-Ahmar, were opened for drainage on 10th November. Abu Nimros escape was opened gradually from the 15th October. The sarf of the west Gizeh chain of basins was completed during the last week of November. The Giza canal hoshahs were all laid dry by the middle of November. On the east of the river Ghamaza escape was opened on the 4th November. Turah feeder was opened for drainage on 23rd October. Der-el-Tin escape was partially opened for "takhlif" on the 12th October and fully opened on the 3rd of November. The sarf of east Gizeh was completed by the 20th of November. No cuts in the banks were found necessary for sarf, the new escapes and feeder heads proving sufficient.

The above rises made themselves apparent at the Delta Barrage on the following dates:—

On 28th June or after...	...	...	...	...	...	38 days
On 25th July	„	...	...	...	...	24 ..
On 13th August	„	...	...	...	...	13 ..

The maximum gauge reading recorded at Khartoum was 6·30 on the 2nd September; the corresponding maximum levels occurred at Aswan on the 12th September or after 10 days, and the Delta Barrage on the 16th September or after 14 days. The maximum gauge recorded at Aswan was 16P-6K on 27th September which agrees exactly with the mean maximum. The maximum reading reached on the Rodah gauge was 22P-9K on 25th October, which gave a level of 16·93 upstream of the Barrage. The levels were due to the Upper Egypt Basin discharges, which came on a falling flood.

LAKE VICTORIA NYANZA GAUGES.

A communication lately received from the Survey Department states that, owing to the gauges on lake Victoria Nyanza having been moved, the following corrections should be applied, 17 centimetres or 6"·7 should be deducted from the readings of Kisumu gauge subsequent to August 1899, and 28 centimetres or 11" should be deducted from the readings of Jinja gauge subsequent to 21st December 1901. The Entebbé gauge was re-erected after an interval of 5 months in October 1901 at too high a level, but the amount of correction is not known. Hence the Entebbé gauge readings before and after 1901 cannot be compared.

Applying these corrections to the readings given on page 172 of last year's report and adding the readings for 1903 we arrive at the following statement:—

YEAR.	Port Alice (Entebbé).	Port Victoria Kisumu.	Jinja.
	Ft. In.	Ft. In.	Ft. In.
1st October, 1898...	3 2	3 2½	3 1½
1st October, 1899...	2 6½	1 0·6	1 5
1st October, 1900...	1 7	0 6·3	1 0
1st October, 1901...	—	1 1·3	1 5
1st October, 1902...	3 5	—	1 4
1st October, 1903...	5 9½	1 1·3	3 4
31st December, 1903 ...	5 10	2 9·3	3 9

The difference between the readings of the Kisumu and Jinja gauges for 1903 as compared with the years 1899-1901, seem to favour the idea that other unrecorded alterations have taken place. It is proposed in future to record the level on the Kisumu gauge, which is the only one which has a bench mark near it, and to take the reading of 31st December 1903 as 1.50 metres or 4'11".

The mean levels of the lake at the Kisumu gauge as corrected since 1896 are given as follows:—

YEAR.	Mean level at Kisumu gauge.
1896... ..	0.928 metres
1897... ..	Incomplete
1898... ..	"
1899... ..	0.748
1900... ..	0.391
1901... ..	0.508
1902... ..	0.172
1903... ..	0.731

CHAPTER III.

DRAINAGE

The maintenance of drains becomes daily of more importance. Many hundreds of kilometres of new drainage channels have been made in the Delta during the past seven years. In the annual report of 1898, page 147, will be found some remarks as to the expenditure required to keep the drainage channels in the Delta in fair working order. The estimate of the requirements at that time was L.E.33,000 and the kilometrage to be maintained has increased considerably since then. Now the total expenditure on maintenance of drains during 1903 only amounted to L.E.8174 or about 6% of the amount spent on the earthwork, exclusive of dredging in the maintenance of canals. The sum available for maintenance has been considerably reduced since that year, while the kilometrage of channels to be maintained has gone up by leaps and bounds.

Great efforts have been made of recent years to not only clear the beds of canals but recast the sections, and make up the dilapidated banks, so as to render the channels capable of passing an ordinary

flood supply. A large proportion of the cube of earthwork executed under the head of maintenance is due to this making up of banks. This is satisfactory in itself and the fact that it can be done is due to the greater results at present obtained for the same expenditure, owing to more and stricter supervision by reliable officers on contract work, than was the case some years ago. Meanwhile the drains suffer. As the more pressing cases of remodelling canal banks are dealt with, it is to be hoped that a larger proportion of the maintenance expenditure will be devoted to drains. It is also to be earnestly desired that the sums available for maintenance will gradually be increased. For every feddan of land reclaimed and brought under cultivation a corresponding increase to the budget should be made for the maintenance of the canals and drains serving the reclaimed area and rendering it cultivable and contributory to the taxes. It must be remembered that, unless drainage is liberally provided for, reclaimed areas will relapse, and produce, and the returns from taxation fall off.

The weed growth in some of the drains gives much trouble and the latter will doubtless be a perennial one. The conditions under which a drainage channel works being peculiarly favourable to the production of such a growth. A steam weed cutter, which has given good results in England, is now being ordered for trial on the drains in the 1st Circle, which, it is to be hoped, may prove successful.

The question of rotations in drains was raised in last year's report and denounced. The Inspectors of the 1st and 3rd Circles have a good deal to say on the subject. Granted a perfect system of irrigation outlets and drainage inlets, cultivators who used their drains intelligently, and drains of suitable section, rotations would not be necessary and would be objectionable. Properly proportioned drainage inlets would force cultivators to close off their water supply when not required, and would discourage excessive flooding of land. In the absence of the above conditions over large areas, Inspectors will doubtless continue to be forced by circumstances to occasionally impose rotations on drains, to prevent swamping of land, as the lesser of two evils. The Inspector of the 3rd Circle writes as follows on the subject:

"In this province there are many low lying parts, and in large tracts there are net works of drains, and unless we had some control over them, it would mean excessive waste of water, high levels in drains resulting in damage to lands and higher levels in like Mariotis with increased pumping at Mex. I know that proper outlets and rotations are the surest way of avoiding these evils, but the construction of outlets on a large scale means large expenditure, and the work can

only be done gradually with the funds available. Canal (high and low level) rotations are steadily enforced and are of great benefit in flood and winter ; but they are not sufficient when the drains are so close to the canals and water courses, and we have found that in the peculiar circumstances in the province, the drain rotations are most beneficial, they keep drains low, and help to avoid waste and damage to lands. The main and branch drains are not saddled, only the private drains discharging into them ; the rotations are made to fit in with the canal rotations and work excellently. One of the proofs of this is that the people now have a strong desire for these drain rotations, as they get better drainage for their low lands, and we have no complaints whatever".

After an absence of 4 years, I have lately inspected a considerable portion of the Behera Province. The improvement visible on all sides due to improved drainage is very marked. Large areas of what I remember, as marsh in the vicinity of Hosh Issa, Delingat, Damanhour and Rahmanieh, are now quite dry and rapidly coming under cultivation. It is stated that some 25,000 feddans have recently been added to the cultivated area in the province ; unfortunately there are no reliable returns to show progress. The deep envette out in the centre of Khairy drain has proved successful and kept a clear central channel with good velocity. Weed growth was noticeable in places, but the big drains in the first circle seem to suffer more in this respect.

MEX PUMPING STATION.

The following statement shows the results obtained at Mex Pumping Station and compares them with those of the seven previous years:—

SEASON.	Quantity pumped.	Cost	Rate per million cubic metres pumped.	Price of coal per ton.
	C.M.	L. E.		L. E.
1895-1896	175,078,166	7,588	43,004	
1896-1897	216,994,810	8,068	37,000	
1897-1898	227,429,530	8,675	38,000	
1898-1899	284,896,064	8,378	30,000	1.237
1899-1900	202,987,741	9,391	46,261	1.678
1900-1901	316,435,869	11,182	44,818	1.746
1901-1902	384,946,043	13,297	34,548	1.286
1902-1903	396,420,022	12,247	32,205	1.200

The quantity was a record, but was little in excess of the previous year. The rainfall of the season 1902-1903 was 11·27 ins., against 8·55 ins. in 1901-1902, so the small increase must be regarded as satisfactory. Pumping commenced on the 23rd September 1902 and stopped on the 30th April 1903. The price of coal was lower than it has been for five years, and the cost of pumping is the lowest since 1898-1899. The results of the first three seasons in the list cannot be compared with those which follow, as during them a large portion of the pumping was paid for at contract rates which the price of fuel did not affect. The statement which follows shows details of rainfall and maximum and minimum levels of the lake for the past 8 years. It will be noticed that the maximum level has fallen considerably, while the minimum has risen, the difference between the maximum and minimum level for the past season being only 0·33 against 1·0 metre in 1895-1896 and 1899-1900. This result may be attributed to increase of summer irrigation, development of the drainage system for which the lake forms the outfall, and better regulation of flood and winter supplies in the canals. On Plate IV will be found a gauge diagram for the lake for a few selected years.

SEASON.	Rainfall.	Maximum level of lake.	Date of maximum level.	Minimum level of lake.	Date of minimum level.
1895-1896	10·45	—2·15	17th March.	—3·15	22nd August.
1896-1897	8·53	—2·03	7th January.	—2·92	11th Sept.
1897-1898	13·94	—2·17	23rd January & 13th March.	—3·20	27th August.
1898-1899	11·88	—1·95	18th Feb.	—3·26	16th Sept.
1899-1900	8·28	—2·29	27th January.	—3·29	11th August.
1900-1901	10·08	—2·18	19th January.	—3·23	17th August.
1901-1902	8·55	—2·31	4th & 25th Jan.	—2·85	16th August.
1902-1903	11·27	—2·44	23rd January.	—2·78	4th July.

The expenditure incurred during the year on working the pumping station was L.E.13,540. A sum of L.E.377·0 was also spent on extra quarters for the staff, making the total expenditure for the year L.E.13,917·00

CHAPTER IV.

NEW WORKS OF IRRIGATION AND DRAINAGE AND WORKS CHARGED TO SUNDRY SPECIAL CREDITS.

The following statements show the Caisse Credits available for expenditure on special works during the year, the actual expenditure incurred and the balances to be carried forward:—

CAISSE CREDITS, 1903, BY CIRCLES.

	Balance from 1902.	Allocation in 1903	Total	Mortgaged	Unmortgaged	Balance to carry forward.
	L. E. M.	L. E. M.	L. E. M.	L. E. M.	L. E. M.	L. E. M.
<i>1st Circle.</i>						
Irrigation Improvement						
Drainage, Subsidiary Works and Zatta Barage	12,899,937	63,790,000	76,690,937	76,390,937	53,278,940	23,129,988
Damietta Sudd	366,485	—	366,485	366,485	366,487	—
Special Low Nile	—	550,000	281,657	281,657	278,922	2,735
Special Low Flood	—	250,000	250,000	250,000	—	250,000
Ezbet El Borg	2,460,744	—	2,460,744	2,460,744	2,459,744	1,000
Total	15,727,166	64,390,000	79,758,823	79,758,823	56,384,109	23,374,723
<i>2nd Circle.</i>						
Irrigation Improvement						
Drainage, Subsidiary Works	9,911,870	61,290,000	73,911,870	73,911,870	40,959,317	32,952,553
Low Nile	—	800,000	800,000	344,548	344,526	455,472
Low Flood	—	247,000	547,000	547,000	569,111	177,889
Total	9,911,870	65,097,000	75,258,870	74,803,418	41,671,854	33,431,564
<i>3rd Circle.</i>						
Irrigation Improvement						
Drainage	3,274,921	43,000,000	46,274,921	46,274,921	37,110,500	9,164,417
Rosetta Sudd	—	5,000,000	5,000,000	5,000,000	7,870,781	1,129,219
Low Nile	—	2,400,000	2,400,000	725,992	725,618	1,674,382
Low Nile (Art. Pumps)	4,662,593	—	4,662,593	4,662,593	4,110,973	551,620
Low Flood	—	600,000	600,000	600,000	293,568	306,432
Total	7,937,514	55,000,000	62,937,514	61,262,506	50,021,474	11,241,632
<i>Delta Baranque.</i>						
Irrigation Improvement	4,646,787	6,000,000	10,646,787	10,646,787	9,848,462	828,325
Low Nile	—	250,000	250,000	—	—	250,000
Low Flood	—	—	—	4,500,806	747,224	753,579
Total	4,646,787	6,250,000	10,896,787	12,147,593	10,595,686	1,581,904
<i>Zatta Barage.</i>						
Zatta Barage	49,859,744	50,000,000	99,859,744	99,859,744	81,587,849	15,271,925
Subsidiary Works	—	3,500,000	3,500,000	3,500,000	2,682,559	817,441
Total	49,859,744	53,500,000	103,359,744	103,359,744	87,270,408	16,089,366
Grand Totals	88,082,081	244,147,000	332,210,738	331,332,081	245,913,492	87,448,589

CAISSE CREDITS, 1903.

	Balance from 1902.	Original allotment, 1902.	Total.	Modified.	Expen- diture.	Balance to carry forward.
	L.E. M.	L.E. M.	L.E. M.	L.E. M.	L.E. M.	L.E. M.
<i>Irrigation Improvements.</i>						
1st Circle	9,098,882	14,500,000	23,598,882	23,598,882	17,713,738	5,885,144
2nd Circle	3,927,701	27,000,000	30,927,701	30,927,701	14,830,950	16,096,751
3rd Circle	2,402,737	19,000,000	21,402,737	18,202,737	11,479,075	6,723,662
Delta Barrage	4,646,787	6,000,000	10,646,787	10,646,787	9,818,462	828,325
Totals	20,076,107	66,500,000	86,576,107	83,376,107	53,842,225	29,533,882
<i>Subsidiary Works</i>						
<i>Zifta Barrage.</i>						
1st Circle	—	4,000,000	4,000,000	4,000,000	—	4,000,000
Zifta Barrage	—	3,500,000	3,500,000	3,500,000	2,682,559	817,441
Totals	—	7,500,000	7,500,000	7,500,000	2,682,559	1,817,441
<i>Drainage.</i>						
1st Circle	3,801,055	25,000,000	28,801,055	28,801,055	21,553,951	7,247,104
2nd Circle	5,984,169	37,000,000	42,984,169	42,984,169	26,128,367	16,855,802
3rd Circle	871,181	24,000,000	24,871,181	28,071,181	25,631,429	2,439,755
Totals	10,656,408	86,000,000	96,656,408	99,856,408	73,313,717	26,542,691
Totals: Irrigation Improve- ments, Drainage Subsidiary Works	30,732,515	166,000,000	190,732,515	190,732,515	129,838,531	60,893,984
<i>Zifta Barrage.</i>						
Zifta Barrage	49,859,744	50,000,000	99,859,744	99,859,744	84,587,819	15,271,925
1st Circle (spent by)	—	20,000,000	20,000,000	20,000,000	11,011,260	5,988,740
Totals	49,859,744	70,000,000	119,859,744	119,859,744	98,599,079	21,260,665
Mehallat El Amir Sudd	—	9,000,000	9,000,000	9,000,000	7,870,781	1,129,219
Sudds Damietta arrears	366,485	—	366,485	366,485	366,485	—
Totals	366,485	9,000,000	9,366,485	9,366,485	8,237,266	1,129,219
<i>Special Low Nile Credit.</i>						
1st Circle	—	550,000	281,657	281,657	278,922	2,735
2nd Circle	—	800,000	800,000	344,548	343,426	1,122
3rd Circle	—	2,100,000	2,400,000	725,392	725,648	0,344
3rd Circle (Atfeh)	4,662,593	—	1,662,593	1,662,593	4,110,977	551,626
Barrage	—	250,000	250,000	—	—	—
Totals	4,662,593	1,000,000	8,394,250	6,011,790	5,158,968	555,821
<i>Special Low Flood Credit</i>						
1st Circle	—	250,000	250,000	250,000	—	250,000
2nd Circle	—	297,000	517,000	517,000	369,111	177,889
3rd Circle	—	600,000	600,000	600,000	203,568	396,432
Barrage	—	—	—	1,509,803	747,224	753,579
Totals	—	1,147,000	1,397,000	2,897,803	1,319,903	1,577,099
Ezbet el Borg Reservoir	2,160,714	—	2,160,714	2,160,714	2,159,714	1,000
Grand Totals	88,082,081	241,117	632,210,738	631,332,081	215,943,192	85,118,589
					331,332,081	

The total sum under the head of Caisse Credits available for expenditure during the year was L.E. 331,332 and the actual expenditure incurred was L.E. 245,913, leaving a balance of L.E. 85,419 to be carried forward. A large proportion of this balance is due for land taken up, as payments for land proceed slowly, only a small portion of land taken up in any year being paid for during the same year. In addition to the above sum of L.E. 245,913, a sum of L.E. 41,952 provided from the Ordinary Budget, including a sum of L.E. 1,112 realized by the sale of old materials at the site of Zifta Barrage, was spent on Special works raising the total expenditure on the latter to L.E. 287,865.

This expenditure was divided between the Circles as follows:—

CIRCLE.	Irrigation Improvements.	Drainage Works.	Sundry Special Works.	Total.
1st Circle	38,188	25,812	3,105	67,055
2nd Circle	35,546	26,732	713	62,991
3rd Circle	14,492	27,091	12,911	54,494
Delta Barrage	12,747	—	747	13,494
Zifta Barrage	89,831	—	—	89,831
Total	190,804	79,635	17,476	287,865

IRRIGATION IMPROVEMENTS—1ST CIRCLE.

The following statement gives the list of works carried out in the 1st Circle under the head of Irrigation Improvements and the expenditure incurred on each:—

NAME OF WORK.	Expenditure.
New Head Ismailia Canal	8,002
Syriakos by wash	726
Spurs Rayyah Tewfiki and Bahr Moes	2,802
Extension of Um Galagil Canal	824
Extension of Ghazali Canal	1,253
Purchase of materials for stock	1,600
Supply and erection of Boundary Stones... ..	437
New Regulators Sharkia and Dakahlia	1,335
Tail escape Kemeba Canal	246
Suppression of Bowlakia Canal	271
Purchase of land areas 1902	445
Moving work shop of Dredging Company Shubra	1,400
Zifta Barrage Sud-idiary Works	14,632
Establishment and Surveys	4,215
Total	38,188

Of the above sum, L.E.31,725 was charged against Caisse Credits and L.E.6,463 against Ordinary Budget.

Ismailia Canal New Head.—This work was described at length in the last two reports. It has now been satisfactorily completed and was used for regulation during the past flood. Through navigation down the Ismailia and Suez Canals has thus been established throughout the year, and the power of regulating the discharges admitted to these canals placed under complete control. The total cost of the work has been L.E.31,141.

Syriakos By Wash. Ismailia Canal.—This work was built in 1902. The work done during the past year was completion of the channel and connecting up with the main canal ; water can now be passed down the canal without opening the lock gates, a great improvement as regards regulation. The total expenditure has been L.E.9,758.

Spurs Rayyah Tewfiki and Bahr Moes.—Spurs have now been completed from kilometre 1 to kilometre 8, and from kilometre 26 to kilometre 28 in the Rayyah Tewfiki ; 20 spurs have also been built in the Bahr Moes. Similar spurs have done a great deal for the Ibrahimieh Canal and Rayyah Menufia.

Extension of Om Galugil Canal.—This work was started last year and has now been completed ; it includes 6 kilometres of new and 4 of remodelled channel. The canal serves an area of 15,000 feddans in Markazes Miniet Samanoud and Mansurah in Sharkia Province. The expenditure to date has been L.E.2,258. The final account has not yet been submitted.

Ghazali Canal Extension.—This is a small branch of the Bahr Faqus in the extreme north of Sharkia. It has been extended 9 kilometres to bring water within reach of the San-el-Hagar village, which previously had to depend on drainage water.

Purchase of Materials.—The surplus materials at Ismailia canal head were purchased for stock.

Regulators Sharkia and Dakahlia.—They included the following small masonry works:—

Head Sluice	Mahmoud Pasha Taher Canal.
„	Bordein Canal.
„	Hafiz Pacha Canal.
„	Morabia Canal.
„	Sura Canal.
Regulator on	Saarana Canal.
„	Mostagadda Canal.

These are all most useful petty works bringing the supply of the above channels under control, thus improving irrigation and preventing flooding and waste of water.

Tail Escape Kenneba Canal.—This work replaces a sadd which was made and removed yearly.

Bulakia Canal Suppression.—This canal is being suppressed on sanitary grounds. A credit was granted for this work in 1902 and a commencement made. No further credit was forthcoming till the end of 1903, so the work was not completed. It will be taken up again in 1904.

Moving Dredging Work Shops Shubra.—These shops occupied the right bank of the Ismailia Canal below the new head and lock and obstructed traffic. The fleet of dredgers also blocked the canal. The expenditure represents the sum paid to the Dredging Company for shifting the shops to the left bank of the canal on to the plot included between the new head and the diversion channel where there is no traffic to be interfered with. The diversion channel will serve as a basin for the dredgers and relieve the main channel, on which the navigation has greatly increased since the construction of the new lock.

Zifta Barrage Subsidiary Works.—The following statement enumerates the works carried out under this head which consist of the Zaglula and Mit Mohsen Feeder and the Om Salamah-Buhia junction channel with their contingent works:—

NAME OF WORK.	EXPENDITURE.
Zaghlula and Mit Mohsen junction channel..	278
Head to Mit Mohsen junction channel	1,774
Right Gannabia Head on junction channel	494
Mit Mohsen Canal Head on	350
Om Salama Syphon	2,425
Mansuria Syphon	3,398
Light Railway Bridge Om Salama Canal... ..	742
Making and removing Light Railway Bank	415
Om Salama Buhia junction channel... ..	1,709
Regulators at Baramtush where junction channel joins the Buhia Canal... ..	4,244
Head Sluice for Om Salamah Canal below off-take of new junction channel	421
Head Sluice Sanafa Canal Branch of Om Salamah Mit Mohsen junction channel	158
Head Sluice Abid Canal, a branch of the same	217
Shonfas Drain syphon Om Salamah Buhia junction	379
Seven timber bridges.	397
Cost of Stone	260
Marble gauges... ..	38
Total... ..	17,699
Deduct paid in 1902... ..	3,067
Expenditure in 1903... ..	14,632

The Zaghloula Mit Mohsen Feeder takes off above Mit Ghanur Regulator and syphons under the Um Salamah and Mansuria Canals to feed the Zaghloula Canal, which serves the land between the Mansuria Canal and the Nile. On this channel are built heads for a proposed new high level canal on east of the Mansuria, and the existing Gannabiah Mit Mohsen, also for the Sanafa and Abid Canals. The object of these works is to supply water from above Mit Ghanur Regulator to land south of Sannayta between the Nile and Buhia Canal. The head of this feeder consists of one vent of 3 metre span with regulating gate. The Om Salamah syphon consists of 3 pipes of 1.5 diameter, and the Mansuria syphon of 3 pipes of 1.02 diameter. The Light Railway was diverted from the right bank of the Mansuria Canal on to the right bank of the new feeder, being carried over the Om Salamah Canal by a girder bridge of 15 metre span. By this means a bridge over the new feeder, extensive alterations to the Um Salamah Head, and extension of the Mansuria syphon, were avoided. The Om Salamah Buhia junction, 4 kilometres in length, will feed the Buhia Canal with water taken in from the river at Zifta. The

principal works in connection with it are the 2 regulators at its junction with the Buhia Canal, each consisting of 3 vents of 3 metre span. Below the off-take of the junction channel comes a head for the tail portion of the Om Salamah Canal, now considered a branch. The Shonfas Drain Syphon under the Om Salamah Buhia junction, and 7 timber bridges complete the list of works.

IRRIGATION IMPROVEMENTS—2ND CIRCLE.

The following statement gives the works carried out under the head of Irrigation Improvements—2nd Circle.

NAME OF WORK.	EXPENDITURE. L.E.
Remodelling Baguria and Sirsawia Heads	3,023
Remodelling Qoddaba and Bassiun Regulators	2,462
Nagail Canal Project..	11,244
Remodelling and extending Radi Canal	1,745
Salahib Canal	3,230
Pipe syphons Mitherra Canal	1,174
Remodelling and extending Telwana Canal	1,380
Outlets on first 4 kilometres of Bahr Saidi left bank	435
Two regulators on Masraf Babeel	663
Petty Regulators in Gharbia	999
Remodelling Mitbera Regulator... ..	250
Regulating Doors for outlet heads	60
Sharkia Canal head	448
Mehalla Kebir Irrigation House..	700
Improving up-stream approaches Baguria Lock	492
Maps of Gharbia	300
Annex to Office Shubin El Kom... ..	72
Store houses and ghaffirs huts Nanaia and Bagouria Heads ...	361
Kom Ali Regulator Balir Smilla..	292
Purchase of grooves, etc.	132
Railing round Government land Kafr Zayat	50
Four small Regulators Menafia (arrears)	33
Tail regulator Bahr Biela	116
Regulators in Menafia (arrears).	159
Melig Canal	880
Combined Road and Railway Bridge Bassiun	140
Brick burning for new works	2,980
Supply of ironwork by Arsenal	1,000
Establishment	726
Total... ..	35,546

Of the above total, L.E.16,027 was charged against Caisse Credits and L.E.19,519 against Ordinary Budget.

Baguria and Sirsaria Heads.—These were old-type works with imperfect regulation with vertical timbers. They have been repaired and remodelled, so that regulation may be effected by iron gates worked by a travelling winch.

Bassium and Qodaba Regulators.—These important regulators on the Baguria and Qodaba Canals have also been modified so that regulation may be effected by means of gates and winches.

Nagail Canal Project.—Work on this project was started in 1901. It provides for the flood irrigation of a large area in Menoufia and already has proved of much value, obviating the necessity of heavy flood regulation in the Rayyah Menoufia and its upper branches. The expenditure to date has been L.E.24,477.

Remodelling and Extending Raddi Canal.—This project will do for the high land on the east of the Rayyah Menoufia what the Nagail Canal has done for the land on the west of it.

Salahib Canal.—This is a high level distributary along the Bahr Tirah below Salahib three kilometres in length.

Miterba Syphons.—These syphons were completed in 1902 in connection with the Mischerif Flood Canal; the total expenditure to date has been L.E.2,830.

Telwana Canal.—Is another important flood canal in Menoufia which has been remodelled and extended.

Melig Canal.—The old Ghuri Canal and West Ghammabiyah Melig have been joined up into one channel called the Melig Canal, which will serve during flood a large area between the Kassid Canal and Bahr Shibin.

The list also includes 10 small regulators, a few buildings and the provision of materials for projected works.

IRRIGATION IMPROVEMENTS—3RD CIRCLE.

The irrigation improvements in the 3rd Circle are given in the following statement:—

NAME OF WORK.	EXPENDITURE.
	L.E.
Remodelling Baslaqun Canal	4,450
Remodelling Edkawia Canal	852
Remodelling Culverts on Mahmudia Canal... ..	2,891
Extending Weirs Kafr Bulin Escape... ..	560
Remodelling Kafr Bulin Regulator	1,314
Survey	682
Payments for lands... ..	730
Rest Houses Hosh Issa, Delingat and Rosetta	1,399
Rest House Damanhour and Maadia	203
Survey Nubaria Canal	450
Supply Pipes for Baslaqun Canal	277
Fixing Boundary Stones	140
Additions to Head of Khatatbah Flood Feeder... ..	384
Supply pipes for Kafr Bulin Regulator	160
Total... ..	14,972

Of the above expenditure, L.E. 11,479 was charged against Caisse Credits and L.E. 3,013 against Ordinary Budget.

Remodelling Baslaqun Canal.—The Baslaqun Canal is an important branch of the Mahmudia ; it has been entirely remodelled on a length of 13 kilometres and is now capable of irrigating 13,000 feddans :—

Remodelling Edkaria Canal.—This is also a branch of the Mahmudia ; it has been remodelled on a length of 2 kilometres.

Remodelling Culverts Mahmudia Canal.—48 irrigation sluices have been remodelled or replaced by new ones, and 16 sluices, found in excess of requirements, have been removed entirely. This is a most important improvement, affording greatly increased control over irrigation, and thus preventing waste of water and flooding of land.

Extending Weirs Kafr Bulin Escape.—The diaphragm walls of these weirs have been lengthened so as to tie well into the banks.

The dry stone floors were also extended. These weirs have been quite successful in arresting the deterioration of the escape channel.

Remodelling Kafr Bulin Regulator.—It has long been recognized that a new regulator provided with gates was required to replace the tumble down structure at Kafr Bulin. A start was made with the collection of materials and other preliminaries.

The other items in the list call for no special remarks.

IRRIGATION IMPROVEMENTS.—DELTA BARRAGE DIRECTORATE.

The following is a statement of the irrigation improvements executed in the Delta Barrage Directorate :—

NAME OF WORK.	EXPENDITURE.
	L.E.
Collection of materials for proposed Wardan Lock	1,135
Completing Rayyah Behera Head	800
Completing Nikhla Regulator Rayyah Behera	265
Survey	150
Barrage Inauguration	578
Remodelling Khashab Canal	5,993
Remodelling Kafr Terkhan Canal	3,373
Establishment	453
Total... ..	12,747

Of the above expenditure, L.E. 9,818 was charged against Caisse Credits and L.E. 2,928 against Ordinary Budget.

Wardan Lock.—This work will be built in connection with the regulator at kilometre 21 of the Rayyah Behera, which canal will then be navigable throughout its length.

Khashab Canal.—The Khashab is the main flood canal of east Gizeh; its head reach was remodelled to a 10·0-metre bed on the first 5½ kilometres including a diversion of 2·8 kilometres. There was a marked improvement in the flood irrigation of east Gizeh consequent on this work, which will be continued in 1904.

Kafr Terkhan Canal.—This is a branch of the Khashab Canal. It was remodelled on a length of 10·8 kilometres.

ZIFTA BARRAGE.

The expenditure in connection with Zifta Barrage and its subsidiary works was L.E. 89,831 distributed as follows :—

	L.E.
Zifta Barrage proper	21579
Rayyah Abbas and contingent works... ..	39016
Mansuria Head	29235
Total	<u>L.E. 89830</u>

The total expenditure up to date under the same heads has been as follows :—

	L.E.
Zifta Barrage proper	287229
Rayyah Abbas and contingent work... ..	98017
Mansuria Head	34724
Total	<u>L.E. 419970</u>

The Barrage and the Rayyah Abbas were practically completed at the end of 1902. and the inauguration ceremony took place on the 7th March 1903. The expenditure shown was mostly on accounts of arrears from the previous years. These works have been fully described in previous reports and the utilization of the Barrage during flood has been described in Chapter II.

The Mansuria Head on the east of the river to feed the Mansuria Canal was built during the year. It is similar to the Rayyah Abbas Head and consists of 4 vents of 5 metres each and a lock 35m. 8m with double gates. Some expenditure incurred on iron work and joining up with the canal and river will appear in the Accounts for 1904.

DRAINAGE WORKS—1ST CIRCLE.

Drainage Works.—The following is the detail of the expenditure on drainage works in the 1st Circle :—

NAME OF WORK.	EXPENDITURE.
	L. E.
Remodelling Bahr El Bagar drain	9,457
Remodelling Bahr Taweel... ..	2,494
Remodelling Mah-sama Timsah drain	7,046
Mit El Amil drain	1,797
Syphons under Suez Canal	1,496
Extension of Bilbeis drain	2,118
Cost of land	1,000
Branch drain at Suez.	46
Converting the old Saidia Head into a syphon	358
Total... ..	<u>25,812</u>

Of the above expenditure, L.E. 21,554 was charged against Caisse Credits and L.E. 4,258 against Ordinary Budget.

Bahr-El-Bagar and Taweel Drains.—The Bahr-El-Bagar Drain is the outfall for the drainage of 295,000 feddans, and the Bahr Taweel the outfall for 470,000 feddans in Sharkia and Dakahlia. The total length of the Bahr-El-Bagar is 85 kilometres. Work was started in 1897. The whole length of the drain has been widened to bed-widths varying from 14 to 20 metres. The last 50 kilometres are now being deepened by dredging. The progress to date is 18 kilometres, of which 7 kilometres were done last year. The Bahr Taweel proper is only 7 kilometres in length after which it divides into two main branches, the Bahr Faqus and the Hadus Drains. The whole length was originally dredged to a 50.0-metre bed-width with a bed level at the tail of 2.0 metre. The section of the channel is now being recast to a 40.0 metre bed width, the bed level at the tail being lowered to 3.0 metre. A length of $1\frac{1}{2}$ kilometre of the modified channel was completed during the year. A length of 2 kilometres of the main Bahr Faqus branch has also been remodelled during 1902 and 1903.

Mahsana Timsah Drain.—The work done during the year consisted in widening and deeping the first two kilometres of the drain; in replacing 3 pipe aqueducts by one syphon and a length of water course to facilitate dredging and obviate the necessity of lengthening the aqueducts; and in modifying existing aqueducts and bridges, so as to allow of the increase in the section of the drain. A new syphon of two pipes of 1.50 diameter each was built to carry the drain under the Suez Canal, the old syphon being too high.

Mit-el-Amel Drain.—This is an extension $6\frac{1}{2}$ kilometres in length to serve the land between the Om Salama and Mansuria canals.

Syphons under the Suez Canal.—These syphons, two in number, are to dispose of drainage due to rainfall which banks up against the canal.

Extension of Bilbeis Drain.—The expenditure was incurred in paying off arrears for 1902 and in completing Abu Zabel syphon under the Ismailia Canal. Appendix F gives an interesting note by Mr. Molesworth on this work; an interesting example of the application of cement grouting.

Conversion of the Old Saidi Head into a syphon.—This is an old canal head under the Zagazig-Ismailia railway which it is proposed to convert into a drainage syphon by making bore holes in the floor, pumping out the sand from underneath, and replacing it by cement run in as grout. The floor thus thickened will then be cut down to the required level. So far as the work has gone it seems likely to prove successful.

DRAINAGE WORKS IN 2ND CIRCLE.

The following statement gives the detail of the expenditure on drainage works in the 2nd Circle:—

NAME OF WORK.	EXPENDITURE.
	L.E.
Remodelling Batra drain	2,189
Remodelling Samatay main drain	11,652
Remodelling Dahria drain... ..	2,154
Remodelling Abshan drain..	2,152
Remodelling Waziria drain.	3,526
Remodelling and extending Fua-Orban drain	1,404
Compensation for land and crops	468
Surveys	956
Establishment	2,231
Total... ..	26,732

Of the above expenditure, L.E. 24,932 was charged against Caisse Credits and L.E. 1,800 against Ordinary Budget.

In the six drains enumerated a length of 83 kilometres of channel was remodelled. The heaviest job was the Samatay Drain, and the result of the work has been most satisfactory. The Inspector of Irrigation 2nd Circle points out how necessary it is to continue re-casting the sections of all the main drains in a similar manner.

DRAINAGE WORKS IN 3RD CIRCLE.

The following statement gives the detail of the expenditure on drainage works in the 3rd Circle:—

NAME OF WORK.	EXPENDITURE.
	L.E.
Remodelling Umum drain... ..	3,940
Remodelling Damanhour drain... ..	1,808
Remodelling Nediba drain... ..	1,813
Remodelling and extending Nubaria drain... ..	1,775
Constructing Delingat drain	5,410
Extending Khairi drain	3,016
Constructing Rozafa drain... ..	1,536
Constructing Kafr Melit drain	1,495
Constructing Mehallet Bi-hr drain	560
Kafr Beni Hilal drain syphon	804
Sorombay drain syphon	244
E-stablisment and Survey... ..	2,650
Payments for land	2,040
Total... ..	27,091

Of the above expenditure, L.E. 25,631 was charged against Special Caisse Credits, and L.E. 1,460 against Ordinary Budget.

The Umum Drain.—The channel was remodelled on a length of 6 kilometres up to its junction with the Damanhour Drain.

The Damanhour Drain.—The channel was remodelled on a length of 5 kilometres from its junction with the Umum Drain.

The Nediba Drain.—The channel was remodelled throughout its entire length of 10.2 kilometres.

The Nubaria Drain.—The remodelling of the south branch was completed and a small branch 1.2 kilometres in length constructed joining in at the syphon under the Hagar Canal.

The Khairi Drain.—The main drain was extended 5.4 kilometres from the Gabares Drain junction in a south-westerly direction. The central channel was also widened and deepened in its upper reach.

Delingat and Rozafa Drains.—These are important branches of the Khairi Drain 12 kilometres and 4.1 kilometres in length.

The Kafr Beni Hilal Syphon carries the drain of the same name under the Damanhour Dessuq railway line.

Kafr Melit Drain.—This drain starts on the north of the Mahmudia Canal opposite kilometre one and joins the Edku Drain at the crossing of the old Fransiwyah Canal.

The Sorombay syphon carries the drain of the same name under the Shaker canal.

Mehallet Bisher Drain.—This drain runs on the left boundary of the Sahel Markaz Canal to join the Miniet Salamah Drain.

The following statements show the lengths of new channels and existing channels remodelled under the heads of "Irrigation Improvements" and "Drainage Works," together with the cubes of earthwork by hand and dredging executed under each head and the cost of the same.

IRRIGATION IMPROVEMENTS.

CIRCLE.	New channel kilometres.	Remodelled channel kilometres.	EARTHWORK BY HAND		DREDGING.		Total cost Earthwork and Dredging.
			Cube.	Cost.	Cube.	Cost.	
			C.M.	L.E.	C.M.	L.E.	L.E.
1st... ..	19.0	4.0	229,678	3 789	—	—	3 789
2nd... ..	13.7	59.3	792,626	12 693	—	—	12 693
3rd... ..	—	15.0	246,895	4 883	—	—	4 883
Delta Barrage	2.8	13.5	495,124	7 325	—	—	7 325
Totals...	35.5	91.8	1,764,323	28 690	—	—	28 690

DRAINAGE WORKS.

CIRCLE.	New channel kilometres.	Remodelled channel kilometres.	EARTHWORK BY HAND		DREDGING.		Total cost Earthwork and Dredging.
			Cube.	Cost.	Cube.	Cost.	
			C.M.	L.E.	C.M.	L.E.	L.E.
1st... ..	6.5	10.5	92,369	1 314	355,708	13,679 ⁽¹⁾	14 993
2nd... ..	4.0	83.0	1,216,676	12 693	24,829	844	13 537
3rd... ..	37.1	26.0	934,809	16 026	—	—	16 026
Totals...	47.6	119.5	2,243,854	30 033	380,537	14,523	44 556

⁽¹⁾ Includes L.E. 255 paid for work by the day at Abu Zabel Syphon; L.E. 425 work by day at Synacos By wash; L.E. 905 paid on account for Masara Timsah Drain.

EXPENDITURE ON SUNDRY CREDITS.

The following statement shows the expenditure on sundry credits which appear in Appendix A:—

CIRCLE	Name of Credit.	Amount.	HOW SPENT
		L.E.	
1st Circle.	Low Nile . .	279	Working Rotations.
" .	Damietta Sadd	366	Payments for land taken for sadd in 1902.
" .	Ez. El Borg R.	2,460	Arrears for 1902.
2nd Circle	Low Nile . .	344	Working Rotations.
" .	Low Flood . .	369	Irrigation of river sahels.
	Mehallet El		
3rd Circle	Amir Sadd . .	7,871	Construction of sadd.
" .	Low Nile . .	4,836	Repairing Atf Pumping Station. Working Pumps and Rotations.
	Low Flood . .	204	Irrigation of Sahels.
Delta Barrage.	Low Flood . .	747	Permanent banks round high Sahels in Gizeh.
Total . .		17,476	

The only item in the above which calls for remark is the expenditure of L.E. 4,836 against the Low Nile Credit in the 3rd Circle. Of this a sum of L.E. 4,111 was spent in roofing the engine and boiler houses of Atf Pumping Station and the purchase of three new boilers and replacing some gearing.

AGRICULTURAL ROADS.

The annual progress statement is given below :—

CIRCLE AND PROVINCE	Existing at end of 1902.	Added during 1903.	Total at end of 1903.	Expenditure, 1903.
	Kilom.	Kilom.	Kilom.	L.E.
<i>1st Circle.</i>				
Galiubia	107	—	107	—
Sharkia	202½	—	202½	—
Dakahlia	203½	—	203½	—
<i>2nd Circle.</i>				
Menufia	279	—	279	—
Gharbia	767	38	805	12,272 (*)
<i>3rd Circle.</i>				
Behera	281½	—	281½	—
Total	1,840½	38	1,878½	12,272

(*) L.E. 2,957 arrears for land. 2,685 Dessuq Kobri Osman Road not completed and so not included in the statement.

BRIDGES TO REPLACE FERRIES.

The following expenditure was incurred under the above head:—

	L. E.
1st Circle—Bridge on Bahia Canal at Toukh El Akkam	100
3rd Circle—Completing Swing Bridge on Khatatbah Canal	1,620
Total	<u>L.E. 1,720</u>

EXPENDITURE ON BEHALF OF COMPANIES OR OTHER ADMINISTRATIONS.

The following statement gives the contributions made by Companies or other Administrations and expended on special works and the names of the said works:—

CIRCLE	Object for which contribution was made.	Amount of contribution.	Expenditure.
		L.E.	L.E.
2nd Circle . .	Cost of Mohit-Shamarka Canal Head, sluice and tail escape, contributed by Administration of Domains	340	340
.. . .	Remodelling Yusuf Eff. Canal, contributed by Société Agricole	400	400
3rd Circle . .	Maintaining Bridges on Mahmudia Canal, contributed by Municipality of Alexandria.	221	221
.. . .	Working Atf Pumps for the benefit of Kom El Akdar escape, contributed by the Company	176	176
.. . .	Contribution towards cost of Rosetta Rest House by Ministry of Interior	60	60
Delta Barrage .	Construction of Canal and Head Sluice for Warden Estate Company	5,000	4,631
..	Making a bank along the Bahr El Aama, contributed by Ministry of Finance	838	838
	Total	7,035	6,666

Most of the items in the above list call for no remark. The Warden Estate Company have obtained the concession of a large tract of low-lying desert land on the west of the Rayyah Behera on which it is proposed to start arboriculture. A flood canal to serve the estate, 6.4 kilometres in length, was made with a head sluice of three-metre vents.

Bahr El Aama bank.—At the request of the Ministry of Finance the right bank of the Bahr El Aama was moved forward on a length of 1.4 kilometres, so as to bring a large strip of sahel inside it, which will fetch a high price for building sites and gardens.

CHAPTER V.

MAINTENANCE AND REPAIRS.

The following statement shows the total expenditure under the head of maintenance and repairs:—

CIRCLE.	EXPENDITURE.			
	Regular Budget	Corvée abolition.	Sundry Receipts.	Total.
	L. E.	L. E.	L. E.	L. E.
1st Circle	40,765	46,000	251	87,016
2nd Circle	33,233	42,000	792	76,025
3rd Circle	20,751	26,350	1,339	48,440
Delta Barrage	16,566	7,650	1,132	25,348
Totals... ..	111,315	122,000	3,514	236,829

The above expenditure was distributed as follows: —

HEAD OF EXPENDITURE	1st Circle.	2nd Circle.	3rd Circle.	Delta Barrage.	Total.
	L. E.	L. E.	L. E.	L. E.	L. E.
Flood Protective Works	8,080	10,702	6,847	5,093	30,722
Repairs of Structures and general Maintenance	6,544	7,506	8,077	9,857	31,984
Maintaining Roads	1,400	557	500	—	2,457
Maintenance of Canals and Drains ...	70,992	57,260	33,016	10,398	171,666
Totals... ..	87,016	76,025	48,440	25,348	236,829

FLOOD PROTECTIVE WORKS.

The expenditure was distributed as follows:—

HEAD OF EXPENDITURE	1st Circle.	2nd Circle.	3rd Circle.	Delta Barrage.	Total.
	L.E.	L.E.	L.E.	L.E.	L.E.
Purchase of Stone and Building... ..	5,591	10,501	6,487	4,520	27,099
Sundry Materials	—	70	360	245	675
Earthwork	2,489	1,778	911	328	5,506
Totals... ..	8,080	12,349	7,758	5,093	33,280
Deduct charged to Corvée Relief ...	—	1,647	911	—	2,558
Balance... ..	8,080	10,702	6,847	5,093	30,722

The detail of the work done in the 1st and 3rd Circles and the Delta Barrage Directorate is as follows:—

CIRCLE	New Spurs.	Spurs repaired.	New Revetment.	Revetment repaired.
	No.	No.	L.M.	L.M.
1st Circle	4	116	2,512	4,225
3rd Circle	14	88	832	1,688
Delta Barrage	2	28	5,412	2,338
Totals... ..	20	232	8,756	8,251

The details for the 2nd Circle have not been supplied.

The cube of earthwork executed was 347,777 cubic metres. The expenditure was about the same as last year. What is required to make the river banks secure is the steady execution of retirements. A sum of at least L.E.30,000 per annum should be devoted to this work annually for some years in addition to the present annual expenditure of about L.E.30,000. The present allotments for Nile Defence Works only permit of maintaining the existing spurs and revetments and small extensions of the same.

Retirements on the scale required cannot be faced. Needless to say this is the most urgently required work in the Delta seeing what the consequences of a breach in the banks would be.

GENERAL MAINTENANCE.

The most important works executed under this head were as follows:—

In the 2nd Circle. Stone work below canal regulators...	L.E.1,000
In the 3rd Circle. Maintaining Abukir sea wall	„ 3,181
In Delta Barrage. Directorate. Maintenance of gardens. „	1,814
„ Maintaining and working	
Barrage	„ 6,867

The policy of using big blocks of stone for the repairs of Abukir sea wall has proved most successful and the condition of the work is now better than it has been for many years. In fact a large portion of the best consignment of stone is held in reserve, there being no necessity to use it at present.

MAINTENANCE OF ROADS.

As often remarked before, the sum expended on roads maintenance is much too small. An expenditure of L.E.2,457 on the maintenance of 1840 kilometres of roads is ridiculous; about three times this amount would be the minimum with which one could even pretend to maintain the roads.

MAINTENANCE OF CANALS AND DRAINS.

The following statement shows the cubes of earthwork by hand and the dredging executed in the maintenance of canals and drains during the year with the expenditure incurred :—

CIRCLE	EARTHWORK BY HAND		DREDGING		Weed clearance.	Total.
	Cube.	Payments in 1903.	Cube.	Payments in 1903.		
	C.M.	L.E.	C.M.	L.E.	L.E.	L.E.
1st Circle... ..	2,290,617	51,190	680,045	17,148 ^(*)	2,429	70,767
2nd Circle	3,272,984	54,791	28,411	966	—	55,757
3rd Circle	1,015,435	23,355	278,232	9,460	—	32,815
Delta Barrage ...	671,000	10,398	—	—	—	10,398
Totals... ..	7,250,036	139,734	986,688	27,574	2,429	169,737

(*) A cube of 182,470 out of this was paid for in 1902. A large proportion of the cube of earthwork was done in remodelling canal banks. In the 1st Circle 65 kilometres of banks were remodelled and the other circles were doing as much or more. The Inspector of the 2nd Circle states that several hundred kilometres of canal channels have been remodelled during the past few years.

The cube executed and expenditure incurred in maintenance of drains included in the above statement were as follows:—

CIRCLE	EARTHWORK BY HAND		DREDGING		Weed clearance.	Total.
	Cube.	Cost.	Cube.	Cost.		
	C.M.	L.E.	C.M.	L.E.	L.E.	L.E.
1st Circle... ..	345,250	5,910	—	—	954	6,864
2nd Circle	77,811	1,420	14,706	500	—	1,920
3rd Circle	77,000	1,390	—	—	—	1,390
Totals	500,061	8,720	14,706	500	954	10,174

The above is a very small proportion of the total expenditure on earthwork. The Inspector of 2nd Circle explains that the early arrival of high levels in the canals put a stop to the work on drains which was in progress.

The following is the 5 years statement of dredging executed in maintenance of Canals and Drains.

Five years' statement of quantities of dredging done in maintenance:—

CANALS AND DRAINS.	1898-1899	1899-1900	1900-1901	1901-1902	1902-1903
	C. M.	C. M.	C. M.	C. M.	C. M.
1ST CIRCLE.					
Ismailia Canal	322,471	225,096	190,799	152,006	302,776
Sharkawia Canal	125,557	77,462	82,647	101,668	72,975
Bassussia Canal	152,854	195,969	229,835	246,157	107,295
Kumbatia Canal	51,412	62,504	84,622	70,886	64,905
Bahr Saghir Canal	2,823	70,197	32,115	31,818	—
Mansura Lock	22,648	15,000	21,437	14,624	—
Suez Branch	—	—	—	29,001	132,184
Bahr el Bagar	—	—	—	5,410	—
Total	677,765	646,228	641,455	654,570	680,045*
2ND CIRCLE.					
Rayyah Mennia	399,937	255,535	112,567	131,176	—
Qasid Canal	—	138,204	—	—	—
Bahr Tirah	74,810	5,959	—	—	—
Qudlaba Lock	10,530	5,512	13,363	—	13,705
Baguria Head	—	4,124	2,380	4,014	—
Kafir Rabaa Lock	—	—	—	5,966	—
Muhit Drain	—	—	—	—	14,706
Total	485,277	409,634	128,310	141,156	28,411
3RD CIRCLE.					
Rayyah Behera and Khatatbah Canal	185,982	136,516	149,915	82,266	114,837
Malunudia Canal	123,434	117,530	159,921	142,027	163,395
Nubaria Canal	37,980	17,843	—	—	—
Total	347,396	271,889	309,836	224,293	278,232
Grand Totals	1,510,438	1,327,751	1,079,601	1,020,019	986,688
Expenditure L E....	—	—	—	—	27,574

* Of this 182,170 was paid for previous to 1903.

In the 1st Circle the bed levels of the Ismailia, Sharkawia, Bassussia and Kumbatia Canals were raised 0.40, on account of the higher levels now maintained above the Delta Barrage. This accounts for the decrease in dredging in the last three channels. A large cube was done in the Ismailia and Suez Canals in the interests of navigation.

Dredging has almost ceased in the 2nd Circle, a fact which the Inspector ascribes to recasting of sections of canals, using regulators sparingly in flood, the spurring of canals, and the abolition of double sources of supply to wit : the Bir Shams Feeder to the Rayyah Menufia.

CHAPTER VI.

THE WADI TUMILAT ESTATE.

The progress made by this estate continues to be most satisfactory. The following statement shows the capital expenditure during the year, and compares the original estimate of capital expenditure required with the actual expenditure up to date:—

HEADS OF EXPENDITURE.	Original Estimate.	EXPENDITURE.	
		During 1903.	Total to end of 1903.
	L.E.	L.E.	L.E.
<i>Drainage and Reclamation Works.</i>			
Enlargement of pumping station.. ...	6,000	—	4,279
Enlargement of main drain	17,000	—	14,676
Branch and field drains and field channels ...	15,189	290	8,215
<i>Remodelling Irrigation Systems.</i>			
Wooden bridges and pipe heads... ..	—	50	—
	10,000	50	8,767
<i>Purchase of Plant.</i>			
Barge for pump dredger	—	119	—
	2,500	119	3,024
<i>Staff and Farm Buildings.</i>			
New Ezbehs	8,500	97	2,877
<i>Steam Ploughing, Staff and Sundries.</i>			
Pay of staff, travelling allowance and sundries	—	368	—
Ploughing.	—	108	—
	3,000	476	3,461
Totals L.E.	62,189	1,032	45,299

The total capital expenditure during the year was L.E.1,032, and the capital expenditure up to the end of the year L.E.45,299. A small amount of drainage work still remains to be done on the west of the Ismailia Canal; this cannot be carried out till the old Saidia Head under the Ismailia Railway has been converted into a syphon.

It will not be necessary to borrow any more money for the completion of the works since, as will be shown below, the surplus of revenue over expenditure is considerable.

REVENUE ACCOUNT.

The receipts and the expenditure during the year are as follows:—

RECEIPTS:—

									L.E.
Balance brought forward from 1902	...	...	...	...	...	...	...	...	1,708
Rent of land (16,922) feddans	...	...	...	...	...	...	...	...	27,514
„ „ Palm trees	...	...	...	...	...	...	...	...	406
„ „ Water mills	...	...	...	...	...	...	...	...	152
„ „ Incubator.	...	...	...	...	...	...	...	...	20
„ „ Grazing and Wild Samar...	...	...	...	...	...	...	...	...	185
Sundries	...	...	...	...	...	...	...	...	168
Total...									<u>L.E.30,153</u>

EXPENDITURE:—

									L.E.
Staff	...	...	...	...	...	...	...	...	2,340
Kassassim pumps..	...	...	...	...	...	...	...	...	3,684
Payment to Public Instruction	...	...	...	...	...	...	...	...	8,000
Taxes...	...	...	...	...	...	...	...	...	5,875
Maintenance of canals and drains	...	...	...	...	...	...	...	...	1,675
Petty expenses and travelling allowances	...	...	...	...	...	...	...	...	193
Measures for prevention of cattle plague	...	...	...	...	...	...	...	...	29
Total...									<u>L.E.21,796</u>
Surplus...									<u><u>L.E.8,357</u></u>

Deducting the balance carried forward, the net profit on the year's working was L.E.6,649.

COMPARISON OF ESTIMATED AND ACTUAL RECEIPTS.

The following statement compares the estimated and actual receipts:—

YEAR OF NEW MANAGEMENT.				Expenditure.	Receipts.	Surplus.	Deficit.
				L. E.	L. E.	L. E.	L. E.
Original forecast	...	...	1st ...	19,350	15,710	—	3,640
			2nd ...	19,350	17,200	—	2,150
			3rd ...	19,350	19,700	350	—
			4th ...	19,350	22,500	3,150	—
			5th ...	19,350	23,750	4,400	—
Actual results...	...	...	1899 ...	15,827	16,025	198	—
			1900 ...	19,643	19,957	314	—
			1901 ...	20,418	21,138	720	—
			1902 ...	21,151	22,744	1,593	—
			1903 ...	21,796	28,445	6,649	—

Hence it appears that the net surplus on the five years of working is L.E.9,474 against the estimate of L.E.2,110.

The growth of expenditure is due to increase of area and consequent increase in the maintenance of irrigation and drainage channels.

The area rented during 1903 was 16,922 feddans. The forecast for the year was 12,000 feddans. Hence it appears that the estate is developing at a satisfactory rate. Of the 16,922 feddans rented there remain 2,655 feddans still uncultivated.

CROPS.

The areas under the various crops were as follows:—

	Feddans.
Cotton.	4,731
Maize... ..	3,580
Rice	2,182
Samar... ..	3,190
Sesame	310
Ground nuts... ..	224
Vegetables... ..	50
	— 14,267
Uncultivated	2,655
	<u>16,922</u>

The rent collected works out to about 30% of the value of the crops.

KASSASSIN PUMPING STATION.

Tables have now been made out by Mr. Brooke for calculating the discharge of the pumps from the revolutions and lift.

The following statement gives details of the working of the Station for the last three years:—

YEAR.	Area rented fedd.	Quantity pumped	Quantity pumped per feddan.	CONSUMPTION & COST OF COAL.			Lift.	Expenditure for the year.
				Coal consumed.	Cost of Coal.	Coal consumed per million c.m. lifted.		
				Tons.	L.E.	Tons.	Metres.	L.E.
1901	12,367	60,660,000	4,917	1,753	3,099	29	2'65 to 3'60	3,961
1902	15,200	76,550,000	5,036	2,001	3,240	26	2'55 to 3'01	4,234
1903	16,922	89,548,000	5,292	2,099	2,994	23½	2'45 to 2'77	3,684

Mr. Langley explains the increase of cube pumped per feddan as being due to the increase in area of land under reclamation consuming large quantities of water, as compared with old cultivated land consuming much less water. The satisfactory reduction in the consumption of coal is doubtless due to the reduction in lift consequent on the improvement in the outfall drain.

After being warded off for a long time by strict precautions the cattle plague finally appeared on the estate, and up to the end of February had carried off 410 head of cattle. All possible precautions are being taken.

The following is the estimate of receipts and expenditure for 1904:—

RECEIPTS:—

Rent of land (17,000 feddans)	...	...	...	...	...	...	...	...	L.E. 30,000
„ Palm trees	...	...	...	...	...	...	...	...	400
„ Water mills	...	...	...	...	...	...	...	...	150
„ Incubator...	...	...	...	...	...	...	...	...	20
„ Wild Samar	...	...	...	...	...	...	...	...	100
Sundries	...	...	...	...	...	...	...	...	130
									<u>L.E. 30,800</u>

EXPENDITURE.—

Staff	...	...	...	...	...	...	...	...	L.E. 2,841
Kassassin pumps	...	...	...	...	...	...	...	...	3,800
Taxes	...	...	...	...	...	...	...	...	5,916
Payment to Public Instruction	...	...	...	...	...	...	...	...	8,000
Maintenance of canals and drains	...	...	...	...	...	...	...	...	2,000
Petty expenses	...	...	...	...	...	...	...	...	200
									<u>22,757</u>
Estimated Surplus...									8,043
									<u>L.E. 30,800</u>

Mr. Langley and Moussa Bey Ghalib are to be congratulated on a successful year's working.

CONCLUSION.

STAFF.

Sir Hanbury Brown retired from the post of Inspector General, Lower Egypt, on 10th April and was succeeded by me.

The circles were held as before. Mr. Tottenham acted as Inspector of the 2nd Circle for a considerable portion of the year, while Mr. Dupuis was absent on missions and leave.

Mr. Molesworth, Director of Works, was transferred from the 1st to 2nd Circle in December.

Mr. Hurley replaced Mr. Molesworth, his mission as Resident Engineer on Zifta Barrage having terminated on completion of the work.

Mr. Roberts joined the 2nd Circle as Surveyor of Contracts.

Mr. Grieve, Surveyor of Contracts, resigned. Omar Bey Abdel Barr and Ali Eff. Showki, Chief Engineers, retired.

Mohamed Bey Choukri and Ahmed Bey Helmi, Chief Engineers of Menufia and East Gharbia, died. Mohamed Eff. Zohdi replaced Ahmed Bey Helmi deceased in East Gharbia. Mohamed Eff. Zahed was transferred from Dakahlia to Menufia, to replace Mohamed Bey Choukri deceased, and was replaced in Dakahlia by Mahmoud Eff. Fahmi.

K. E. VERSCHOYLE.

Inspector General of Irrigation in Lower Egypt.

APPENDICES

APPENDIX A.

ABSTRACT OF ACCOUNTS, 1903—IRRIGATION DEPARTMENT, LOWER EGYPT.

REGULAR HEAD.	1st Circle.		2nd Circle.		3rd Circle.		Barrage.		Zifta Barrage.		TOTALS.	
	L.E.	M.	L.E.	M.	L.E.	M.	L.E.	M.	L.E.	M.	L.E.	M.
<i>Establishment.</i>												
Classified staff	9,434.414		8,654.981		7,053.258		2,819.250		—		27,961.903	
Unclassified staff	4,399.473		4,130.937		2,877.583		3,686.935		—		15,094.928	
Travelling charges.	2,983.813		3,241.313		2,654.012		814.940		—		9,694.078	
Telegrams	251.789		305.405		130.997		67.000		—		755.191	
Dahabiyas and rent of offices ...	362.081		—		200.000		125.000		—		687.081	
Office charges and furniture ...	315.249		215.321		60.000		19.844		—		610.414	
Total... ..	17,746.819		16,547.957		12,975.850		7,532.969		—		54,803.595	
<i>Works.</i>												
Irrigation improvements	6,463.000		19,519.000		3,013.000		2,928.000		1,449.000		33,372.000	
Drainage works	4,258.000		1,800.000		1,460.000		—		—		7,518.000	
Flood protection... ..	8,080.000		10,702.000		6,847.000		5,093.000		—		30,722.000	
Maintenance and repairs of structures and sundry expenditure..	6,519.000		6,714.000		6,739.000		8,725.000		—		28,697.000	
Repairs of roads... ..	1,400.000		557.000		500.000		—		—		2,457.000	
Pumping stations	—		—		14,367.000		—		—		14,367.000	
Maintenance of canals and drains	24,767.107		15,261.791		6,664.541		2,747.942		—		49,441.381	
Totals, and Regular Budget..	69,233.926		71,101.748		52,566.391		27,026.911		1,449.000		221,377.976	
<i>OTHER CREDITS.</i>												
Corvée abolition... ..	45,999.990		41,999.261		26,349.872		7,649.999		—		121,999.122	
Agricultural roads	—		12,749.747		—		—		—		12,749.747	
Bridges to replace ferries... ..	100.000		—		1,619.857		—		—		1,719.857	
Contribution by other administrations	—		740.000		236.130		5,469.174		—		6,445.304	
Sundry receipts... ..	251.024		791.840		1,339.074		1,131.490		1,111.000		4,624.428	
<i>SPECIAL GRANTS BY CAISSE FROM GENERAL RESERVE.</i>												
Irrigation improvements	17,713.738		16,027.316		11,479.075		9,818.462		—		55,038.591	
Drainage works	21,553.951		24,932.000		25,631.129		—		—		72,117.380	
Special Low Nile Credit	278.922		343.426		1,836.621		—		—		5,458.969	
Special Low Flood Credit... ..	—		369.111		203.568		747.224		—		1,319.903	
Mehallet El Amir dam	—		—		7,870.781		—		—		7,870.781	
Damietta saddle (arrears)	366.485		—		—		—		—		366.485	
Zifta Barrage	—		—		—		—		84,587.819		84,587.819	
Zifta Barrage subsidiary works..	—		—		—		—		2,682.559		2,682.559	
Subsidiary works 1st Circle ...	14,011.260		—		—		—		—		14,011.260	
Ezbet el Borg Reservoir	2,459.744		—		—		—		—		2,459.744	
Totals other credits	102,735.114		97,952.701		79,566.407		24,816.349		88,381.378		393,451.949	
Grand Totals... ..	171,969.040		169,054.449		132,132.798		51,843.260		89,830.378		614,829.925	

APPENDIX C.

LIST OF NEW AND REMODELLED DRAINS EXECUTED UNDER THE HEAD OF SPECIAL WORKS.

NAME OF DRAIN.	New Channels.	Remodelled Channel.	REMARKS.
	Kilometres.	Kilometres.	
<i>1st Circle.</i>			
Bahr El Bagr.	—	7·0	7 bridges, 12 pipes aqueducts. 2 syphons, 22 pipes, 17 bridges.
Bahr Taweel... ..	—	1·5	
Mit El Amal..	6·5	—	
Masama Timsah	—	2·0	
Total... ..	6·5	10·5	
<i>2nd Circle.</i>			
Batra	—	25·0	} 10 new bridges. 15 pipe aqueducts. 37 aqueducts lengthened. 7 bridges modified.
Samatay	—	18·0	
Dahria... ..	—	15·0	
Abshan..	—	10·0	
Wazaria	—	6·0	
Qebrit and Fua Urban	4·0	9·0	
Total... ..	4·0	83·0	
<i>3rd Circle.</i>			
Umum... ..	—	6·0	} 35 bridges made. 51 pipe aqueducts. 8 syphons. 5 pipe inlets.
Damanhour	—	5·0	
Nediba... ..	—	10·2	
Nubaria	1·2	4·8	
Delingat	12·4	—	
Khairi... ..	5·4	—	
Rozafa... ..	4·1	—	
Kafr Melit	11·0	—	
Mehallet Bishr	3·0	—	
Total... ..	37·1	26·0	
Grand Total... ..	47·6	119·50	

APPENDIX D.

List of Canals subjected to the special programme for rice cultivation.

1st CIRCLE.

DAKAHLIA PROVINCE.

Bahia Canal and branches from Barhamtoush new Regulator to tail.
Gabbada Canal and branches, *Bahr Tanah* and branches.
Bahr Saghir and branches from Railway bridge at Dekernes to its tail.
Sharkawiet Faraskour and branches from Badaway Regulator to tail.
Om Salama and branches from Mit El Anil to tail.

SHARKIA PROVINCE.

Saidia Canal and branches, *Saarana* and branches.
Samaana and branches.
Bahr Faous and branches from Demiyeeen canal head, to tail.
Sadi and branches from railway to tail.
Bahr Moes and branches from Safra Regulator North.
Hanout Canal and branches from Boussa Regulator including Hagarsa Canal.
Shebini Canal branches from Zawanel junction including Mit Yazid East and branches.

2nd CIRCLE.

Qaddaba Canal and branches from Badalet El Saidi to tail, this includes the Yusef Eff. Canal, Rashidia Canal and Khalig Berimbal.
Bahr Saidi and branches from head to tail.
Lasefar Canal and branches from head to tail.
Ghonnemi Canal from its bifurcation at Aguzen, northwards, this includes the Shaba and Etbu Canals.
Sajtay Canal and branches from Kafr Gedid Regulator to tail.
Rouena Canal and branches from Hamra Regulator to tail.
Qasid Canal and branches from Khomar Lock to tail including the Kom El Wahal Canal.
Bahr Malluh and branches from Tombara Lock to tail including the E. and W. Gannabias Tombara.

Bahr Tira and branches from the Abshan Lock to tail including the Abshan Canal and Gannabias, Sharkawia and Nozam.

Rayyah Belqas and branches from the Barari Railway to tail; this includes the Sarama, Hafiz Shihab el din, Bahr Maasara, Banawan, and Bishma Canals.

Bahr Shehin and branches from the Barari Railway to tail, this includes Ramly, Fazil, Samar and Hag Sherbin canals.

Sahel Canal and branches from the Barari Railway to tail; this includes the Bahr Hesas and Tell Canals.

Sherbin Canal and branches from head to tail.

3rd CIRCLE.

BEHERA PROVINCE.

The whole of the *Mahmoudia System* and Branches.

The following branch canals of *South Behera Division*:

El Abadia Canal.

Safasif Canal.

Um el Hanash Canal.

Kafr Beni Hilal.

Dessannes and (private) Um dinar Canal.

Kafr Mousaed Canal.

Kala Canal.

Bahr El Akar Canal, and its branches.

Yaden and Akaline, and the Shakir Canal.

APPENDIX F.

Note of Mr. Molesworth on Abu Zaabal syphon.

As will be seen from the drawings, this is a pipe syphon composed of $\frac{1}{2}$ mild steel plates. The length of the pipe is 85 metres and the diameter 1.50 metre.

Owing to the conditions of the locality and the impossibility of drying the Ismailia Canal, it was necessary to place the pipe in position without resorting to the usual practice of diverting the canal.

The method of placing the pipe was by means of dredging a trench to the required depth across the canal, floating the pipe into position, piercing the water-tight doors and sinking into place. The canal banks were then remade over the pipe ends and operations for getting in the necessary pitching and stone-work to protect the ends of the pipe and hold up the banks begun.

The pipe was sunk in February 1902, and all efforts to excavate and get in the pitching by ordinary means failed; in spite of repeated attempts, the springs proving too strong and the nature of the soil at site being such as to render the excavation in such a limited area well nigh impossible.

In August 1902 all attempts to get in the pitching by ordinary excavation were abandoned, and it was decided to sink masonry wells at either end of the pipe and, by boring through the walls of these, it was proposed to establish a through communication. These wells were of brickwork in cement up to a reduced level of 10'000 and, in order to drown out the springs, had to be carried up another three metres in temporary masonry before they could be plugged with grout.

The operations of sinking and grouting were successfully carried out and it only remained to dry the wells and bore through into the pipe. But, on account of the wells not having sunk exactly flush with the pipe ends, spaces were left between these and the backs of the masonry wells. The spaces were as much as 13cms. on the up-stream and 19cms. on the downstream side. Directly holes were pierced through the walls springs started, carrying back through the newly bored holes such quantities of sand and water as to preclude the possibility of enlarging the apertures to the same diameter as that of the pipe.

Various attempts to cut these holes both by divers and other means were made but proved abortive.

In April 1903 it was decided to abandon the idea of getting at the pipe ends in "the dry" and by use of divers, and to resort to the method of grouting. For this purpose, all materials, such as stones, piles, etc., which had been used in the former operations were cleared away from the neighbourhood of the wells, and sand pumps were erected in order to dredge out inverted cones at the backs of the wells with their apices half a metre below the ends of the pipe on the underside. A certain cube was accomplished by this means, but owing to the gravelly nature of the sand, the laborious process of excavating the remainder by

means of divers had to be reverted to. However, the excavation was at length accomplished and everything was got ready for grouting.

To guard against a leakage of cement into the pipe, strong circular wooden doors as shown in Plan III were lowered by divers and tightly wedged up against the pipe ends by means of wooden wedges against the well walls.

A grout tight joint was made between the pipe flange and the wooden door by nailing tarred canvas on the door as a fitting strip where the pipe flange would abut.

The holes already broken through the well walls were stuffed with sacking and the wells themselves filled with sand up to a level one metre above the top of the pipe.

Divers then scrubbed the face of the masonry all round the pipe lip where the grout would form a joint against the well. This was done with foundry brushes the bristles of which were shortened to render them stiffer. On all the dirt and slime being cleaned off rubble stone was lowered and packed round the grout pipes which had been placed on each side of the end of the syphon pipe. The rubble stone was built to a level equal of one third the way up the vertical diameter of the syphon pipe, thus filling up the lower part of the dredged cone. This layer was then grouted up, the cement used being "Casale Monferrato" and a solid block of masonry was obtained under the end of the pipe syphon and against the wall back.

In order to economise grout, wooden boxes were constructed so as to overlap the well sides and saddle over the pipe, their position will be better understood from the drawing. They were fixed by iron tie bolts which, on being screwed up, gripped the overlapping ends of the boxes against the well walls. After the first layer of grout had been cleaned these boxes were filled with rubble stone by the divers to a height of half a metre above the large pipe. On this being done, the boxes were covered with sacking and a talus of sand was formed round the sides of the box by passing the sand through a pipe manipulated as a slute from above. This was done to prevent leakage of cement under and through the boxes.

The boxes were then grouted up through the same pipes as were used for the lower layer.

The masonry blocks thus formed were allowed two days in which to set and the wells were then unwatered cleared of sand, and the sacking removed from the holes in the well walls.

Everything was found to be quite watertight and the enlarging of the holes to the same diameter as the inside of the syphon pipe was proceeded with.

This was accomplished and the wooded doors cut through and a perfectly watertight joint was found to exist round the pipe end and against the well back.

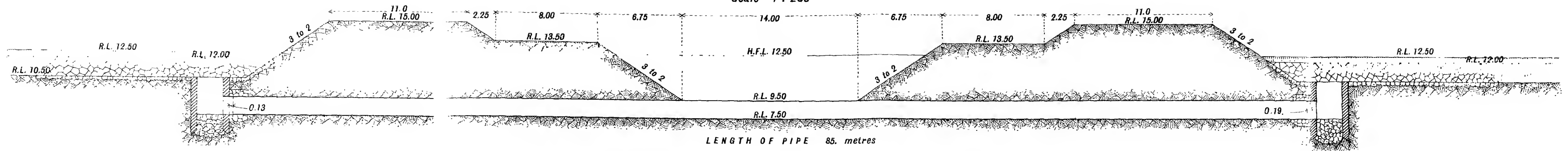
Thus for an outlay comparatively small, as compared with the expense incurred in the endeavours to complete the syphon by other means, the work was successfully finished.

* EGYPT, INCLUDING GOVERNMENT AND WAKF'S LAND, AND LAND OF THE DAIRA SANIEH
OF THE FLOOD OF 1902 TO THAT OF 1903.

RECAPITU	LATION.
Gardens	12,348 14
Winter Crops	2,186,585 15
Summer Crops... ..	1,437,591 7
Nil Crops... ..	1,178,249 17
Total...	4,834,775 5

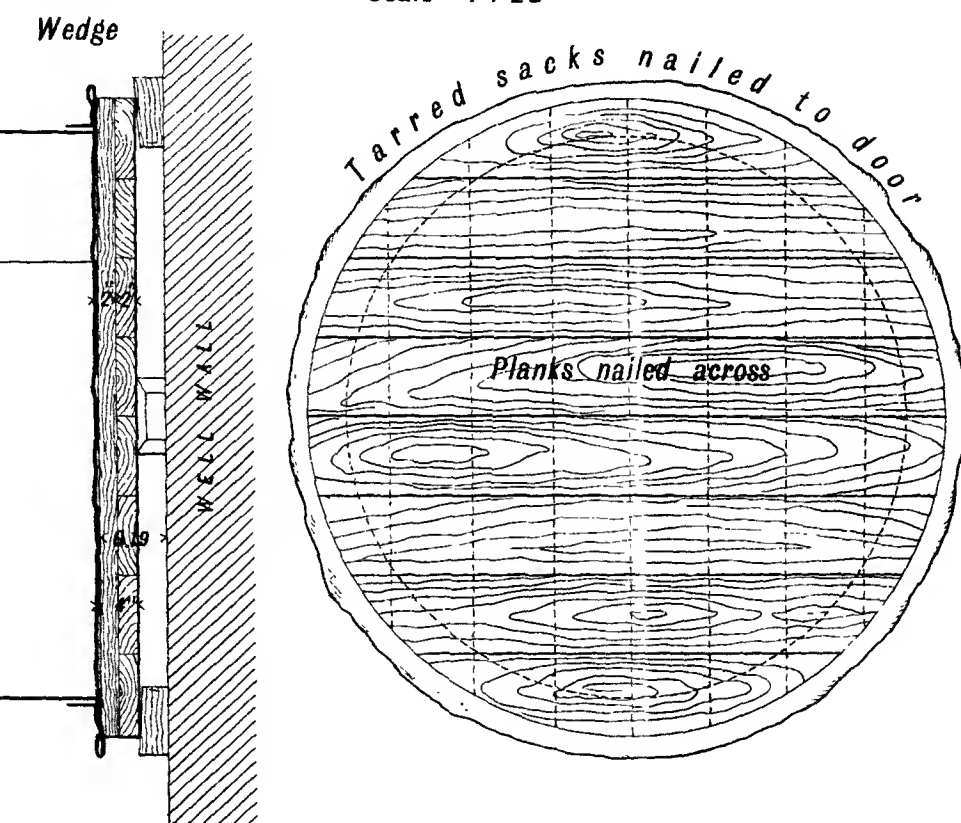
LONGITUDINAL SECTION OF SIPHON

Scale 1 : 250



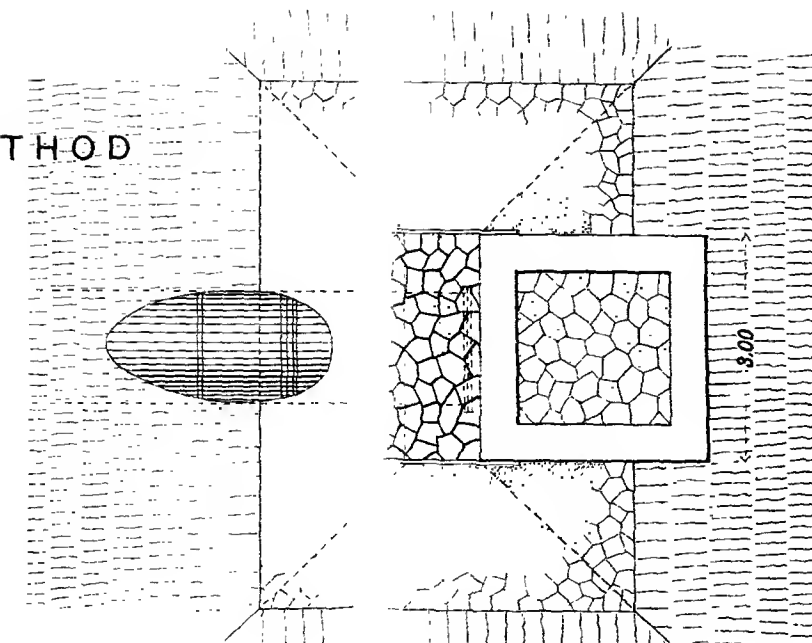
DETAILS OF TIGHTLY WEDGED WOODEN DOOR

Scale 1 : 20

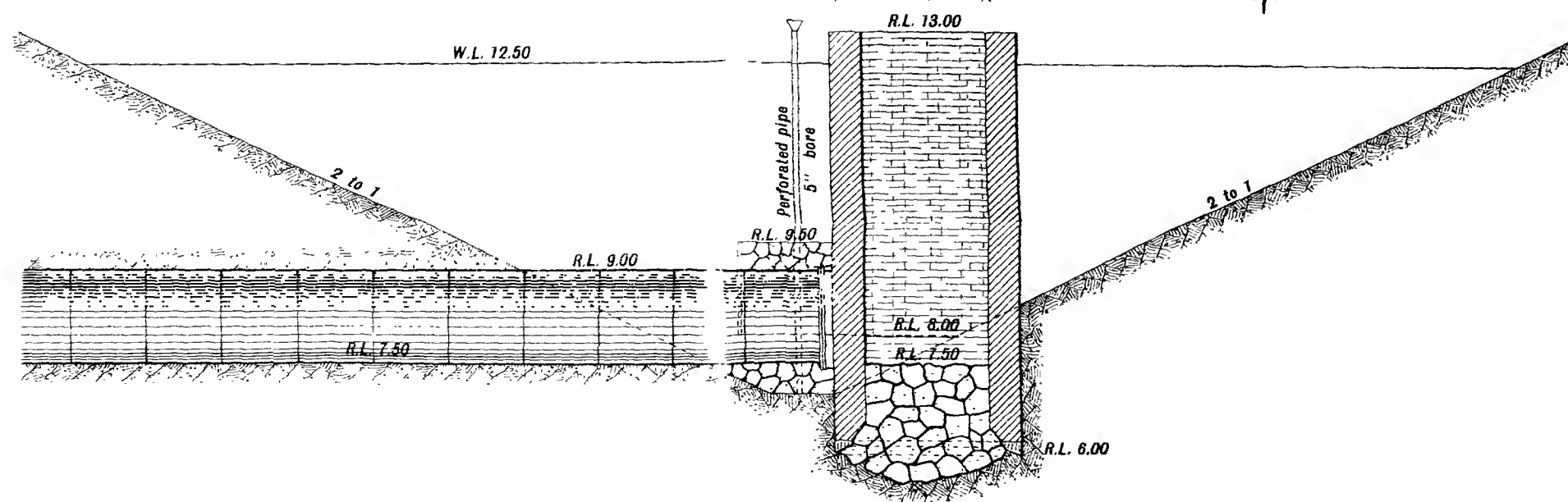


PLAN & SECTION,
SHOWING GROUTING METHOD

Scale 1 : 100



Total Length of pipe 85. metres
Diameter 1.50 metres
Plates $\frac{1}{2}$ " thick
Cover plates $\frac{1}{2}$ " thick
1 Irons 4" x 4" x $\frac{5}{8}$ ".
Rivets $\frac{7}{8}$ " diam.
Pitch 3"

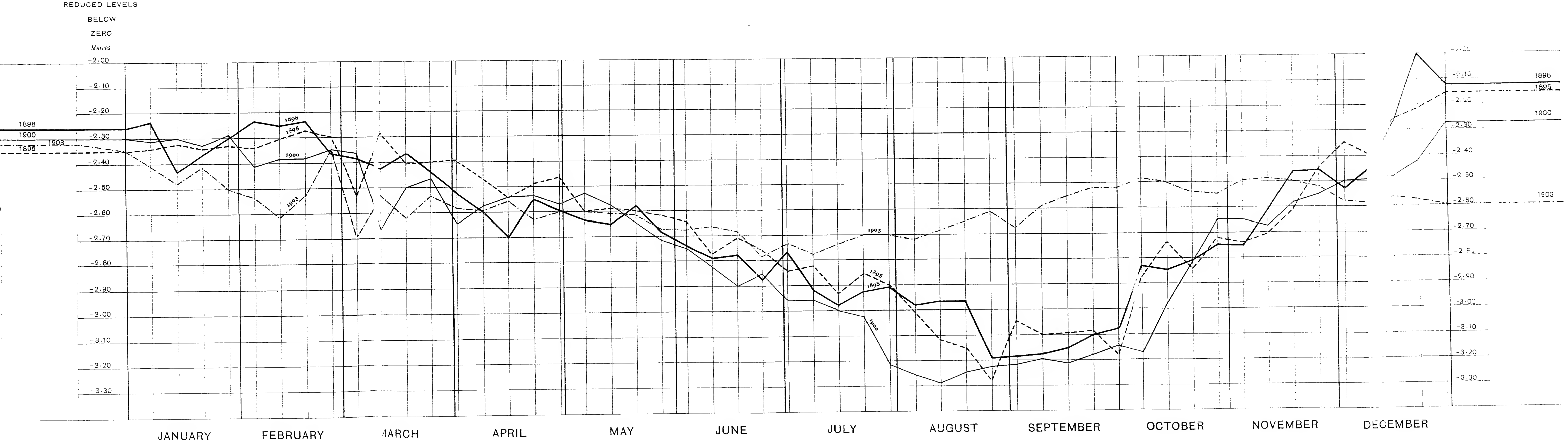


BILBÊS DRAIN

SIPHON UNDER ISMAILIA CANAL
AT ABU-ZABAL

LAKE MARIOTIS

GAUGE DIAGRAM



Scale 1 : 500,000

Agricultural roads	_____
State Railways	_____
Light Railways	_____
Mutiria boundaries	_____
Regulators and Bridges	_____
Rest houses	_____
Canals	_____
Drains	_____

E	120.000
D	110.400
C	130.500
B	133.900
A	145.000

A	6350
B	6370
C	66.143
D	192460
E	192,700

REPORT ON THE TANZIM DEPARTMENT,

1903

BY

A. H. PERRY.

REPORT ON THE TANZIM DEPARTMENT, 1903.

Cairo, May 30th, 1904.

TO THE UNDER SECRETARY OF STATE,
PUBLIC WORKS DEPARTMENT.

SIR,

In accordance with your instructions, I have the honour to submit my yearly report on the Tanzim Department after revising and abridging the part referring to new works and repairs.

The following Officers are specially commended:—

Chief Inspectors.—Messrs. Hewat and Clifton.

SPECIAL WORKS' OFFICE:—

Inspector.—Mr. Pastour.

Director of Works.—Mr. A. De Cosson.

Chief Engineer.—Mr. Watson.

Special Inspection East.—Mr. Richmond.

North Inspection.—Mr. Schanffele.

East Inspection.—Mr. Chapman.

West Inspection.—Mr. Ehrlich.

Cairo Voirie and Tanzim.—Mr. Reboul.

Waterworks, Nurseries, West Roads' Circle.—Mr. Curtis.

Gas, Cart Service and Stores.—Mr. Fitz-Patrick.

Accounts Office.—Yussef Eff. Habib.

I have the honour to be,

Sir,

Your obedient servant,

A. H. PERRY,

Director General of Towns and State Buildings.

GENERAL

NEW WORKS

The total sum spent on new works completed or in course of construction during 1903 amount to:

	L. E.	
Upper Egypt	21,964	Appendices
Lower Egypt	58,874	Nos. 1 and 2.
Total... ..	L.E. 80,838	

LOWER EGYPT

WORKS TAKEN OVER FINALLY IN 1903.

The ARAB MUSEUM AND KHEDIVIAL LIBRARY was finally taken over in September last ; the Museum was opened to the public on the 28th of December. The removal of the books to the Library is in progress.

The interior painting of the Library was postponed until after the arrival of the steel book-cases from Europe. It is now finished.

The exterior of the building has recently been cleaned, several additions have been made and others are still in progress.

The imitation marble balustrade for the Library staircase has not proved a success and will, I hope, be replaced by one of real marble before long. The cost of this failure is borne by the contractor.

WORKS COMPLETED DURING 1903 OR STILL UNDER CONSTRUCTION.

Egyptian Museum.

(1) Residence of the Secretary General.

Besides a dwelling house containing 9 rooms for the Secretary General this building contains 4 rooms used as offices for the Director General of the Museum and for the clerical staff.

It has been occupied since September last.

(2) *Workshops and Sheds.*

These buildings are of a very simple character. They consist of stores and repair shops for the excavating plant of the Museum Direction, and cabinet makers and model makers' shops.

They were handed over last January.

(3) *Boub's Lodge, Boundary Wall and Latrines.*

These were completed at the same time as the workshops. The handsome railings forming the southern boundary were transferred from Gizeh Museum.

(4) *Changing Roofs of Skylights.*

The Museum skylights as originally designed were of two distinct types: the 1st being entirely of glass with sloping roofs; the 2nd having sides only of glass with flat ferro-concrete coverings.

The former were considered by M. Maspéro to be objectionable, owing to the risk of accident in case of the glass breaking and also on account of the excessive amount of light admitted. It was further found impossible to keep such large glass roofs absolutely water tight. They have, therefore, been altered and are now exactly similar to the 2nd type. The work was begun after the tourist season and is now finished.

(5) *Mariette Pasha's Monument.*

The monument erected in honour of Mariette Pasha stands in front of the Egyptian Museum to the west of the principal entrance.

The plan is based on that of the exedrae of the ancient academies.

Upon the central axis is placed the granite sarcophagus of Mariette Pasha, behind this stands his statue raised upon a pedestal which is flanked on either side by a colonnade of square pillars arranged on the usual apsidal plan and surmounted by a cornice. This colonnade is built of marble taken from the grand staircase of Ismail Pasha's Palace at Giza and forms a backing to seats facing the sarcophagus. The statue, which is 3 metres in height, is of bronze and represents Mariette Pasha standing with folded arms in front of a broken block of granite; he holds a plan of the Museum in his right hand.

The pedestal and statue are respectively the work of M. Edouard Mariette and M. Denys Puech of Paris. M. Prampolini, of the Public Works Department, designed the remainder of the monument.

The work was begun in February 1903 and completed in February 1904. It was carried out by M. Camillo Beato for the sum of L.E. 990.

(6) *Khedivial Library, book and exhibition cases.*

The contract for the supply of these was given to Mr. Panzer of Berlin.

There are 24 book cases of various sizes, capable of holding 51,000 volumes, and 27 glazed exhibition cases which will contain the more valuable manuscripts.

Both book and manuscript cases are made entirely of steel and glass and are absolutely dust proof.

The cases are now being erected by a staff of fitters sent specially from Germany, and should be finished early in March.

The cost of the installation will be L.E.7,000 or L.E.1,000 less than the estimate.

(7) *Arab Museum supplementary works.*

A pavement of cement tiles has been laid round the entire building with a garden surrounded by iron railings at the south end. Railings have also been erected along the east façade and round the entrance to the basement to prevent passers by from disfiguring the walls.

Numerous improvements, such as partitions and extra doors have been added to the interior of both the Museum and Library.

It has recently been decided to provide both the main entrances with lobbies and swing doors. These will shortly be ordered and will, I hope, be the last of the items required to complete the building.

B.—Interior.

(1) *Port Said Governorate completion.*

This building was taken over provisionally last February.

The Government offices are on the ground floor, the upper storey being the residence of the Governor General.

(2) *Kom Hamada Police Barracks.*

This markaz is the last of the old type.

The contractors, Messrs. Boyer and Parizot, were considerably handicapped throughout by the difficulty of getting materials to Kom Hamada and the slowness and expense of railway transport.

The building was finished last July and has been occupied since that date.

(3) *Belbeis Police Barracks.*

This building was completed in December. It is of the new type of markaz.

The contract was well and accurately carried out, and reflects great credit on the contractor, Ali Badawi.

I have previously drawn attention to the excellent work of this our only native contractor. The business-like methods which he uses in dealing with his contracts and in organising the work generally, might with advantage be imitated by many of the European firms with whom we have to deal.

A boring has been made in the yard of this markaz and water found at RL + 5.40 (4 metres below the surface). This water, though organically pure, was found to contain a large quantity of salt, and the boring was therefore continued to RL—4.60. No more water was found however, the ground between RL+5.40 and RL—4.60 being stiff clay.

The water at RL+ 5.40 is now being pumped and is apparently fit for horses to drink.

(4) *Tanta Police Barracks.*

This building was begun last May by Mr. Tréhaki. It is similar to the Belbeis Markaz, but has 3 rooms only on the 1st floor for the Inspectors of Finance and Interior, as accommodation for the Mudir and for the irrigation officials already exists at Tanta.

The work should be finished in June.

(5) *Cairo Central Fire Brigade Station and Police Barracks.*

This building is now nearing completion. Besides the fire station and barracks for 128 police, there is a hospital to contain 20 beds and quarters for the Commandant of Police and the Principal Fire Brigade Officers.

The ferro-concrete foundations were described last year, and I will now confine myself to giving an outline of the work since their completion.

The elevation masonry, for which Mr. Garozzo is the contractor, was begun in November 1902 and was, with exception of the tower, finished last October.

The floors and roofs, which are in the Hennebique system of ferro-concrete, were also completed by that date. Some of these floors did not fulfil the specified conditions when tested under $1\frac{1}{2}$ times their calculated load and were consequently refused and demolished. All these are now remade and the second tests have in every case been satisfactory.

Bad centring, by allowing the concrete to sag before it has properly set, frequently ruins a floor when the materials and workmanship are otherwise good.

The plastering, joinery, staircases and sanitary work were begun as soon as the masonry was finished and are now well advanced.

The exterior of the building is plastered with hydraulic lime and sand, while for the inside work ordinary lime and sand are being used.

The fire engine and fire escape house and stables are paved with Staffordshire blue bricks ordered from England for the purpose. The engine house is also fitted with patent quick opening doors, the fittings for which were supplied by Messrs. Shand and Mason; steel sliding poles ordered from the same firm provide a means of quick descent from the firemen's quarters to the ground floor.

Recently the progress of the work has been somewhat retarded by a slight settlement of the foundations caused by the considerable difference between the weights of the tower and building proper. The building of the tower was suspended and the ferro-concrete foundations stiffened by lateral ribs arranged so as to spread the weight of the tower over a much larger area than before, and thus minimise the inequality of the loading on the soil under the foundations.

After allowing sufficient time for the new ribs to set, the masonry of the tower was continued and is now nearly finished.

This work is an example of the adaptability of the ferro concrete system of construction, this method of stiffening being more easily executed than ordinary underpinning.

In spite of this delay, the work will, I hope, be finished by the end of March, only one month after contract date.

The design, which has been much admired, is by Manescaeo Bey.

Zagazig Mudiria.

In the year 1902 it was decided to reconstruct the Mudiria buildings. The condition of the existing buildings, in spite of the fact that they were only 20 years old, was, generally speaking, so bad as to render any attempts at effective reparation useless. A large proportion of the building was in a dangerous state. The drawings and other documents for the new Mudiria were prepared under the supervision of Mr. Clifton. The examination of the tenders and the subsequent superintendence of the construction was entrusted to Mr. Richmond.

Tenders.—No tender was regular in all respects and no tenderer had completely informed himself of the conditions he pledged himself to fulfil. The tender presented by MM. Koressios and Allana, amounting to L.E.35,000, was accepted as being the lowest and the most regular.

Site.—It was necessary to arrange the site in such a manner as to prevent the work of reconstruction interfering with the occupation of these existing buildings which were still in a stable condition and which were needed for carrying on the business of the Mudiria. The site was, therefore, divided into two parts. One of these is destined for the accommodation of the new Tribunal and Markaz. When these buildings are completed the Mudiria staff will be moved into them, the remainder of the site will then be free for the reconstruction of the buildings for the Ministries of Finance and Interior and for the Summary Tribunals. On the completion of the whole a redistribution of the staff into their proper buildings will take place.

The demolition of the buildings upon that half of the site taken over by the contractor began on September 9th. The remainder of the year was spent in carrying on demolitions and in preparing the foundations of the new Tribunals. Materials sufficient for a year's work were brought to and stacked upon the site.

C.—Justice.

(1) Mansourah Summary Tribunal.

The commencement of this building was delayed owing to difficulties in connection with the purchase of the site. These have now been disposed of and work was started in December.

The court is placed on part of the site of the old Mansourah Shouna where the new Mudirieh and the Mahkama Sharia will also be built.

Before these are begun, however, accommodation will have to be found for the Irrigation Stores at present on the site.

(2) *Cairo Mixed Tribunal additions.*

This contract, which was undertaken by Messrs. Padova, Léon Rolin & Co., is divided into two parts.

(a) The Annexes to the east of the main building which consist of a Summary Court room, a room for the archives, and the offices.

(b) Upper Storeys on the two wings of the existing Mortgage Office.

Both buildings are of a simple character and require no detailed description.

The Mortgage Offices are already finished, while the Annexes are well advanced and should be ready for handing over on the expiration of the contract in March.

Patent rolling shutters have been fitted to the Archives Office, as the height of these windows above floor level is such that it would be inconvenient to open and shut the ordinary type of shutter.

At the suggestion of the contractors the locally manufactured "Massarah" cement was tried for one of the ferro concrete floors of the annexes. This floor, when tested under $1\frac{1}{2}$ time the specified load, proved so satisfactory that the contractor was authorized to use Massarah cement for the ferro concrete roofs of the building, on condition that each roof was tested. The results of these tests were in every case excellent.

D.—Posts.

(1) *Port Said Post Office.*

This building was completed and handed over to the Posts Administration last April.

During the progress of the work it was decided to suppress a portion of the upper storey, as the building originally designed contained more accommodation than was required.

E.—Education.

(1) Cairo School of Law.

This building was completed last October. Accommodation for 200 pupils is provided with a large lecture room, a library, administration block and quarters for the principal.

The foundations and most of the elevation masonry were finished in 1902, and during the past year, the work has consisted chiefly of plastering, joinery, floors, staircases, etc.

The building is fitted with electric light.

This design, which has found much favour, is also one of Manescalco Bey's.

(2) Shihin El Kom School.

This school was finished in April 1903. Accommodation for 150 pupils is provided in the main building which consists of a central block and two wings. There is also a large dining hall and kitchen.

A prayer room and a house for the Public Instruction Inspectors are still required, but no funds are at present available for these.

(3) Sanieh School.

This is the largest of the buildings at present under construction.

The ferro concrete foundations, which were described last year, were completed in October 1902, and since that date the progress of the work has been steady, though at times somewhat slow. The masonry, floors and roof are completely finished, and plastering and joiners work are well advanced, while a start has been made with the wooden verandah round 3 sides of the building.

Unless some unforeseen delay occurs the work should be ready to be handed over by 13th of June next when the contract period expires.

Since the commencement of the building a large number of modifications have been introduced at the request of the Public Instruction authorities whose requirements appear to have altered considerably since the original plans were approved by them. These changes include the conversion of two dining-rooms into one, the entire remodelling of the servants quarters, extra entrances to the play ground, and

numerous structural alterations to the interior of the main building. We are fortunately able to execute them without incurring any excess on the estimates, but the amount of extra work involved by the necessity of altering plans, rearranging prices, etc., was considerable.

The Ministry of Public Instruction have also asked for other additions to the building, notably a house and lawn-tennis court for the English teachers, a boundary wall to enclose the land added to the site since the original estimates, and a hot water supply for the school.

The cost of these was estimated at L.E.4,000 which sum was not available last year; it has, however, been sanctioned for 1904 and the new works will be begun shortly, and, I hope, finished at the same time as the rest of the school.

Mr. Clifton expresses his entire satisfaction with the work of the contractor, M. Basile Antoniou. This gentleman undertook the contract at a particularly low price, one in fact which can leave but a bare margin for his profit. In spite of this he has spared no trouble or expense in providing the best materials and workmanship obtainable.

Credit is also due to our resident Engineer Ibrahim Eff. Bourhan.

F.—Prisons.

The only work in connection with the Prison Department during the past year has been at Zagazig; there a laundry, a kitchen and work-shops have been built and a latrine block is now under construction.

During the absence of Mr. Rodeck, the Prisons Administration architect, on sick leave, M. Slater has been transferred from this office to supervise the Prisons buildings.

UPPER EGYPT

Survey Department.

Helwan Observatory.

Meteorological.—This building is on a plateau and the floor level is 114·675 metres above sea level, and is designed with the rooms enclosing a quadrangle. The rooms are all sheltered from the sun by an inner and outer verandah. The main entrance is in the principal façade and faces west and is under the tower containing the 9-ton settling tank. There are also entrances in the quadrangle on the north and south, the latter for access to the annex containing E.C., bath room, kitchen, servants rooms, store and service E.C.'s.

The main building contains sitting room and bedroom for the superintendent, dark room, workshop, room for the standard clocks with double walls, rooms for seismographs, anemometers, recording rooms and offices. In all 12 rooms. The ashlar stone pedestals for standard clocks and seismographs are well into the rock foundation. The floors are 1 metre above ground level, hollow underneath and well ventilated with cast iron gratings in the outer walls and arched openings in the inner walls.

A filtering tank receives the water from the 9-ton settling tank, and clear water is distributed throughout the main building and annex. The bath room and kitchen are supplied with hot and cold water. These buildings are founded on rock. English locks are fitted to all doors.

Transit.—This building is 101·60 metres to the east of the Meteorological Observatory and is designed to contain the Transit instrument and the 2 collimators. These are supported on ashlar stone pedestals. The floor level is 118·779 above sea level, hollow underneath and well ventilated. This building is also founded on rock. The vertical and horizontal iron shutters were supplied by Messrs. Cook, of York, England, and were fitted up by M. Boyes, of the Bulak Engine Works. These shutters are all worked from inside.

Equatorial.—This building was designed to carry the 30-foot diameter muntz metal dome supplied by Mr. Cook, of York. The floor level is 125·596 above sea level and the dome roller path is 4·08 above floor level.

The height from floor level to top of the dome is 8.75 metres. The floor is $1\frac{1}{2}$ metres above ground level. Great care had to be exercised in laying the roller path, on the ashlar masonry. The dome and all fittings were erected by Mr. Boyes, of Bulak Engine Works, and as a proof of the excellency of the work done, the dome can be turned round on its roller path with only one hand on the rope controlling the travelling gear.

Magnetic.—The building is of exceptional design, the object being to maintain in the interior rooms for magnetic observations a temperature of from 1 to 5 cents, also that the hygrometric condition of the air should be such as to avoid moisture being deposited on the instruments. The walls are double, each being 0.75 cents, in thickness with double roofing of the same thickness. There are 3 interior and one exterior rooms with interior passages 1.50 in width all round the 3 rooms. There are 19 ashlar pedestals well bedded into the rock upon which will be placed the magnetic and other instruments. The interior doors are double, padded with cotton and covered with green cloth, and are worked by balance weights. The brass locks and brass basement openings were specially made in England. All the materials used in the building had, of course, to be non-magnetic. All brass work was tested before being put into the building.

The excellence of the site upon which all these buildings are erected and the fact that the surrounding hills are Government property, form a sufficient guarantee, for the future protection of Observatory interests. The transfer of all these buildings from Abbassieh to the Mokattam hills on the eastern side of Helwan now, I believe, adequately fulfil the requirements of the Survey Department.

Ministry of Public Instruction.

Polytechnic School, Ghizeh.

(Vice Principal's House).

This house which forms part of the contract for the Polytechnic School now under construction was completed in October. It is a similar house (but larger) to that designed and built in 1902 for the Principal of the School of Agriculture and Polytechnic School.

The cost has been L.E.1,740.327 against L.E.1,588.010 the cost of the latter.

The area occupied is 315 square metres and cost L.E.5.52 per square metre, Mr. Mackenzie's cost L.E.5.87 per square metre.

New Latrines, Beni-Suef and Ghizeh Schools.

The new latrines, tank and pump, etc., built at Beni-Suef School will form part of the new School when money is available.

The new latrines built at Ghizeh School replace the old Mohamed Aly type to be found in almost all these old schools. The filthy condition of these latrines should be seen to adequately realise their condition. The Sanitary Department should at once condemn all these old latrines such as I found at Edfou, before the new latrines were built in 1902.

Public Works Department.

South Enclosure Wall, Zoological Gardens.

This wall is 433.40 metres in length and for a short distance crosses the lake. It is built of brickwork with concrete foundations and an artificial stone cap.

The cost was L.E.1,090 or L.E.2.52 per lineal metre.

Justice.

Luxor Summary Tribunal.

A Summary Tribunal was built at Luxor for the Ministry of Justice. It is of the type adopted for all Egypt by the Commission appointed in June 1899 and approved by the Judicial Adviser in the same year. Some modifications are being made in the Fayum Tribunal under construction.

GENERAL

During the months of January and February the terms of the general and technical conditions for building contracts and the printed forms made use of in the Building Department were entirely revised by Mr. Richmond. As regards the first, the work consisted in arranging the sequence of the existing clauses so as to agree, as far as possible, with the various stages of the operations to which they apply. Existing clauses were, in many cases, remodelled in accordance with

needs indicated by experience. Forty-five new clauses for the most part dealing with technical requirements were drafted. Copies of the proposed conditions were sent to the Inspectors for their opinions on the reception of which the work was again revised before submission on the 3rd March to the legal authorities. After further discussion the draft was sent in its final form to be printed on the 13th April.

The printed forms used for the preparation of quantities, specifications, sanctions, procès-verbaux, and monthly payments were rearranged with the object of allowing wider spaces for figures and thus diminishing the chances of error in sums and quantities. This work was carried out on lines similar to those followed in the revision of the general specification. Preliminary drafts having been prepared they were submitted to the Inspectors for their opinions. After the final form had been decided on 144,700 copies were printed.

The new forms as well as the new general and technical conditions have been in use since the month of May.

Many demands have been made on my Department for the loan of engineers. Mr. Pastour was occupied on work for the Alexandria Municipality Commission (from September 1902 to the end of that year); Mr. Watson was transferred to the Sudan (from March to September 1903); Mr. Slater, as already mentioned, has been lent to the Prisons Department.

These transfers are extremely prejudicial to the efficiency of my Department especially in view of the limited number of capable officers at my disposal.

The incompetence of a large proportion of the permanent Tanzim engineers is thrown into bolder relief in proportion as the duties devolving on them become more arduous.

There has been a considerable improvement in the drawing and working out of details made by the engineers staff. I regret to find that owing to the very low rate of salary which can be paid the tendency is for those who have mastered the general principles to leave us for better paid employment in the irrigation, etc.

The admitted insufficiency of permanent officers has led to the employment of a number of provisoires agents. Many of these are equal or superior in capacity to the graded staff. By Finance Circular, No. 735, dated 30th November, 1901, however, we are forbidden to raise the pay of these employés above L.E. 8. They very naturally resign when better terms are offered.

The Tanzim Department has suffered great loss in the retirement of Said Pasha Choncri to whose long and faithful services I would pay a grateful tribute.

REPAIRS

Appendices Nos. 5 and 6.		L.E.
	The value of the public buildings existing in 1896 may be taken at	5,000,000
	Between the years 1896-1903 buildings were con- structed to the value of... ..	1,204,000
		<hr/>
		L.E.
	The amount required for repairs to the old buildings at an average of 3% equals per annum... ..	150,000
	and for the new at $\frac{1}{2}\%$	6,020
		<hr/>
	Total	<u>L.E.156,020</u>

Against the 156,020 required per annum we have at present a budget allowance of L.E. 58,925 including Prisons, Sanitary and Customs.

Special credits were granted to the amount of L.E. 17,500.

A question which has reached an acute stage is the delapidation of the Government offices in Cairo and the provinces. Many of these are in a state which renders repair impossible, except at a cost out of all proportion to the advantages gained.

Proposals will be submitted in 1904 for reconstruction of the most insecure of these buildings.

The Opera House has been condemned as thoroughly unsafe as regards danger from fire. There are no satisfactory exits.

With the budget at our disposal my report can only be a record of unsatisfactory makeshifts.

Among the more important repairs executed in 1903 may be mentioned,

	L.E.
Modifications to Opera House	1,050
1st storey on P.W.D. Laboratory	800
Annexe to Printing House... ..	650
Conversion of women's Prison at Bulak into girls' School	650
Partial renewal roof Gouvernorat	650
Play ground and grand stand for Darb-el-Gamaniz School... ..	1,450
Renewal roof Caisse de la Dette... ..	300
Modification of the Egyptian Institute	350
Sorting room and general modifications Post Office	900
Repairs to Dakadlieh Mudirieh... ..	725
.. to Damietta Gouvernorate	500
.. to El-Arich Gouvernorate and wells... ..	1,000
.. to Mansurah School.	605
Restoration Kom-el-Chongafa catacombs..	2,475
Repairs to Ras-el-Tin School	3,000
.. .. Palace	14,500

A certain percentage of the roof area of various ministries has been completely modified. The old system of adding a layer of concrete whenever a leak was discovered resulted in some cases in the imposition of a permanent load varying from $\frac{2}{3}$ to $\frac{1}{2}$ a ton per square metre of the supporting joists. The factor of safety was in many cases reduced to 1.

RAS-EL-TIN PALACE.

The renewal of the roofs of the palace and its annexes were begun in 1901 and completed in 1903.

The work on repairing a roof area of $3\frac{1}{3}$ acres was put up to tender on the 5th January 1903, and the whole work was completed in three months for a sum of L.E. 14,500.

The total roof area of Government buildings in Alexandria and Behera (excluding Customs which figure for 10 acres) amounts to nearly $16\frac{1}{2}$ acres.

78% of this area is asphalted.

In 1903 $4\frac{3}{4}$ acres were entirely renovated, the renewal including roof timbers.

The total area renewed since 1901 comes to $10\frac{3}{4}$ acres.

Some 60% of the flooring of buildings dating from 1830 is rotten and must be renewed.

An examination into the cause of leakage through the roof of the new ferro-concrete tobacco stores roof in Alexandria led to the discovery of a sag in the main girders, the flexure being in one case $4\frac{1}{5}$ of the span instead of $\frac{1}{16}$.

The girder was demolished and in course of this operation it was found that the workmen had omitted to put in the proper number of stirrups forming the web connecting the iron compression and tension bars and that a certain number had been placed upside down.

The efficiency of this excellent system is more or less at the mercy of careless workmen.

The heavy tests applied act, however, as an almost perfect guarantee.

The construction and supervision of works of the Customs Administration was withdrawn from my Service for reasons explained in your official No. 7,236 of 25th November 1902 which read as follows:

“It is assumed by the Customs, that the Ports and Lights, by using their existing staff and the extensive plant they possess, could work far more cheaply and expeditiously than a contractor. Theoretically the argument is sound and the project worth a trial.”

Some 16 works, detailed below, were carried out by the Customs :—

1. Inflammable store on Gabbari Quay.
2. Kiosk with 3 rooms for Mamour and storekeepers on Gabbari Quay.
3. Kiosk, one room, for guards on Gabbari Quay (gate 32).
4. Kiosk, 2 rooms, for guards and gate-keeper on Gabbari Quay (gate 23).
5. Foot bridge over railway and coal quays.
6. Kiosk, 2 rooms, for gate-keeper with room above for guards (gate 14).
7. New 3rd class, Taftich and Passport Office with quarters above.
8. Kiosk, 1 room, for Mamour Kism 7.
9. Kiosk, 1 room, for gate-keeper (gate 8).
10. Room over guards' office at gate No. 6.
11. Painting, etc., outside main building.
12. Alteration to stores in Tobacco Department.
13. Enlargement of parcel posts by including another store from the Tobacco Department.
14. Repairs to roof of old Menoufieh.
15. Walls round sheds No. 5, 7, 9, 13 et 14, one metre high.
16. Painting, etc. Sheds No. 12, 13, 14, 15 and 16.

Of these only Nos. 1, 5 and 7 were executed by the Port Engineer, but they were, I believe, given to contract and not carried out by utilising the plant or staff of the ports.

The rest of the works were given to contract by the Customs in the same manner as had previously obtained. The execution was not, I believe supervised by engineers.

I infer, therefore, that the spirit of the arrangement made has been infringed and that no benefit has resulted, unless freedom from technical control can, under certain circumstances, be considered as such.

THE SMALLER MAHKAMAS.

Appendix
No. 8.

In 1901 Mr. Hewat designed two type buildings for Egypt which were approved and signed by the Ministry of Justice. In Muderyah towns there are the Mahkama Ahliyah (which are being built gradually), the Mahkama Sharia and the Mahkama El-Markaz El-Sharia. In districts, the two latter only are required. There are in Upper Egypt 8 Mahkamas Shariyahs and 42 Mahkamas Markaz.

The present condition of these buildings is most deplorable. They are generally dwelling houses, rented and quite unsuitable for the work to be done. Mr. Hewat reports that he found the clerks at work in a room with a mud floor and open to the sky, summer and winter. In Manfalût much the same state of things obtains. The filthy condition of the many Mahkamas which he visited are, he says, beyond description.

The plans and documents for adjudication have been ready for two years, but no money has been found to build, either large, or small.

LIST OF MAHKAMAS SHARIYAH.

(MOUDIRIEH).

IN UPPER EGYPT.

MAHKAMAS SHARIYAH.

GOVERNMENT PROPERTY OR RENTED

1.—Gizeh	Government
2.—Beni-Suef	Rented
3.—Fayum	Government
4.—Minieh	Rented
5.—Assiut	Government
6.—Guergueh	Rented
7.—Kench	Government
8.—Aswan	Government

LOCAL COMMISSIONS

Appendices
Nos. 9, 10, 13,
14.

Small water works now exist in the following towns :—

LOWER EGYPT.	UPPER EGYPT.
Mehallet-el-Kebir	Sohag
Kafr-el-Zayat	Minieh
Zifta	Girga
Chebin-el-Kom	Luxor
Mit Ghamr	Beni-Suef
Zagazig	Keneh
Benha	
Mansurah	

Installations on a larger scale are projected:—

at Zagazig	... ..	L.E.	6,640
Mansurah	... ..	..	18,000
Menuf	... ..	..	4,860
Chibin-el-Kom			
Damietta			
Damanhour			

At Aswan the capacity of the 10-h.p. engine and pumps was calculated to give a sufficient discharge for road watering in addition to a supply of 25 litres per head taken on 75% of the population.

This provision was in comparison with the measured supply drawn at Tanta very ample and from experience should have avoided the necessity of additional pumps for many years.

The town Council, however, after only two years, are erecting additional engines and pumps of 17-h.p. and have shown a satisfactory profit in spite of undoubted waste of water.

The rejection from motives of false economy of the proposals of the Public Works Department to maintain a mechanical engineer for the purpose of insuring the proper supervision of the water-lifting machinery led to the break down of the Aswan pump and caused considerable unnecessary expenditure.

The engineer has now at my urgent appeal been reinstated. Small fire engines have been bought by the Local Commission of Damanhur.

Aswan and Fayum. The Engineer in Chief of the Local Commissions reports that at present there is no mechanic capable of working them in the villages. (Vide the following extract from the Egyptian Gazette of the 15th May 1904:—

“THE FIRE ENGINE.

“Medinet-el-Fayoum’s new fire-engine was found to be absolutely “useless this morning when a fire broke out, as the engine could not “work owing to its injector being out of order. As a result the house “where the conflagration occurred was completely burnt out.”

In my opinion far too much liberty in technical matters is granted to the Local Commissions.

The authority of the High Commission which is a purely deliberative body where the opinion for the technical member is only of equal value with that of the non technical does not constitute an efficient check.

LUXOR, HORSE GEAR PUMP.

In May it was decided to put a pump in the well existing in the English Cemetery, Luxor. Advantage was taken of this opportunity so as to enable us to water the Karnak road and also give sufficient water supply for the cemetery garden from the same well.

A Hayward and Tyler horse gear and deep well pump was ordered. The pump is a 3-throw with barrels 3" diameter and suction and delivery 2".

The pump is placed 2·50 metres below top of well. The well is 1·50 diameter and the maximum rise and fall in the well (flood and summer levels) is 7·30 metres. The well is 10·30 deep. By opening or closing a valve, either the cemetery can be watered, or the water raised to the road watering tank. A tank of 7 metres capacity with columns, etc., has been erected on the Karnak road.

This tank can be filled in one hour.

The cost was :—

	L.E.	M.
Pump and gearing from England	66	250
Tank columns, etc.	99	662
Masonry foundation, etc.	64	534
Erection of ironwork... ..	50	380
Total... ..	<u>L.E.280</u>	<u>826</u>

GIRGA WATER SUPPLY.

The pumping station is placed at the north end of the town. A 4-h.p. Tangye petroleum engine drives a 3-throw vertical double acting pump. The water is raised direct from the river into a 30-ton tank placed on the top of the building. The suction is 5 inches in diameter and the delivery pipes 6 and 5 inches. 751 metres of 5-inch piping and 352 metres of 6-inch piping were laid through the town. At different points in the town arrangements are made for the water supply to the inhabitants and a service adopted for street watering.

The sanctioned amounts were :—

	L.E.	M.
Masonry	735	000
Pump engine and piping, etc.	936	074
	<u>1,671</u>	<u>075</u>

The actual cost has been :—

	L. E.	M.
Masonry	649	184
Pump engine and piping, etc.	934	155
Total	<u>L.E.1,583</u>	<u>339</u>

Balance in hand L.E.87,736.

This pumping station and all others in Upper Egypt are now handed over to the Ministry of the Interior. Future works and repairs will not be taken in hand by us.

SUHAG WATER SUPPLY EXTENSION.

To admit of a water supply at the higher parts of the town, the tank with a capacity of 28 cubic metres was raised 2·50 metres. A new petroleum engine of 6 h.p. was substituted for the 4 h.p. 278 metres of 5" piping were laid and stand pipes for street watering were placed in convenient places in the town. A 3-throw lift and force pump with 3 vertical barrels and top gearing was substituted for the old centrifugal pump in May 1901.

The works were completed in April 1903, and the total cost of this extension was L.E.472,911.

WATER WORKS.

Owing to the technical ignorance of many of the Tanzim engineers, great difficulty has been experienced in obtaining reliable data on which to base statistics of the cost of water raised by the local Commissions water works. The bare cost per cubic meter works out at from 0·7 to 1·94 milliemes ; if we double the maximum figure to allow upkeep depreciation and amortisation and add 100% for inaccuracies we arrive at a figure of 6 mill. per cubic metre.

Appendix
No. 14.

This compares eminently favourably with the mill. 27 per m.c. charged at Assiut by the Cairo Water Company and the local Cairo rates of mill. 27 for filtered water, and mill. 23·14 for unfiltered water.

APPENDICES

Appendix 1.
CHIEF INSPECTION SPECIAL BUILDINGS, UPPER EGYPT.

WORKS COMPLETED DURING 1903 OR STILL IN COURSE OF CONSTRUCTION.

Order	Administration	Contract Date of completion during 1903	NAME of Work	Date of commencement.	Sanction.	Expenditure		Date of completion	Contractor
						Before 1903	During 1903		
I	II	III	IV	V	VI	VII	VIII	IX	X
					L. E.	L. E.	L. E.		
A—1	P.W.D.	20 April 1903	Helwan Meteorological Ob- servatory & Pumping Station	20 August 1902	2,612,000	18,150	2,230,098	10 May 1903	Korossios & Alani
2			Transit	18 December 1902	210,000	—	215,215	1 December 1903	
3			Equatorial		337,000	—	355,592	1 December 1903	
4			Magnetic	7 June 1903	1,335,000	—	1,107,361	30 January 1904	
B—1	Justice.	7 December 1903	Luxor Tribunal	20 October 1902	3,500,000	—	3,303,218	16 August 1903	Canozzo & Fils
2		3 June 1904	Fayum Tribunal	3 June 1903	3,304,000	—	1,123,857	29 April 1904	P. Chara
C. 1	Interior	1 February 1903	Sohag town water supply	1 August 1902	187,200	—	172,911	22 April 1903	Cook.
2		1 September 1903	Giza town water supply ..	1 April 1903	1,671,075	—	1,583,339	17 October 1903	Rizk Said & Cook
3			Fayum small prison	1 October 1903	1,232,361	—	1,232,361	31 January 1904	P. Chara
4		15 December 1903	Luxor Pump and Tank for street watering & canals ..		280,826	—	280,826	15 December 1903	Zaffran & Cook
D—1	Public Health	21 March 1905	Polytechnic School Giza ..	21 March 1903	39,951,000	—	9,999,266	—	S. Zaffran
		21 October 1903	Polytechnic School (Viceroy Principals' House)		—	—	—	21 October 1903	
2		15 July 1903	Ben-Said Latrines School ..	1 April 1903	378,000	—	381,226	15 July 1903	J. Farnach
3		15 September 1903	Giza Latrines School	16 June 1903	312,000	—	307,608	15 September 1903	M. M. Said & Andriassch
							21,961,102		

Appendix 2.
CHIEF INSPECTION SPECIAL BUILDINGS, LOWER EGYPT.

LIST B.—WORKS COMPLETED DURING 1903, OR STILL IN COURSE OF CONSTRUCTION.

Order	Administration.	Date of completion during 1903	Name of Works.	Date of commencement.	Summation.	Expenditure.		Contract date of completion	Contractors.
						Before 1903	During 1903		
I	II	III	IV	V	VI	VII	VIII	IX	X
					I. E.	L. E.	L. E.		
<i>General.</i>									
A—			Egyptian Museum —		4,300	42	3,739	—	Carozzo & Zafarani.
1		9-9-903	Residence of Secretary-General..	—	3,330	166	2,669	—	Do.
2		3-4-903	Workshops and Sheds..	—				—	
3		3-1-903	Boat lodge, boundary, wall and latrines ..	—	3,115	1,985	855	—	Do.
4		—	Changing roofs of skylights ..	1-4-903	2,500	—	1,451	12-2-904	Padova, L. Rolin & Cie.
5		23-11-903	Marjette Pasha's Monument ..	—	932	—	1,599	—	Camillo Benio.
6		—	Khedivial Library Book and Exhibition Cases ..	7-1-903	8,000	—	4,796	7-2-904	Pauner.
7		—	Arab Museum supplementary works..	28-9-902	1,300	585	139	5-3-904	Marsili & Tréshaki.
<i>Interior.</i>									
B—			Port-Saïd Governorate completion..	—	15,000	12,750	1,676	—	Guélin & Charvaut.
1		9-2-903	Kom Hamada, Police Barracks ..	—	3,370	95	2,621	—	Boyer, Parzol & Cie.
2		8-7-903	Belbeis, Police Barracks ..	—	3,714	—	1,799	—	Ali Badawi.
3		31-12-903	Tauka, Police Barracks ..	6-5-903	3,153	—	1,630	6-3-904	A. Tréshaki.
4		—	Cairo Central Fire Brigade Station and Police Barracks ..	28-11-902	20,057	6,611	9,513	28-2-904	L. Carozzo.
5		—	Mansourah Summary Tribunal ..	29-12-903	1,000	108	14	29-4-905	Ali Badawi.
C—			Cairo Mixed Tribunal additions ..	22-3-903	8,080	216	1,359	22-3-904	Padova, L. Rolin & Cie.
D—			Port-Saïd Post Office ..	—	25,325	16,656	3,273	—	Guélin & Charvaut.
<i>Education.</i>									
E—			Cairo School of Law..	—	22,100	9,867	7,379	—	Makar & Pilegraffi.
1		31-10-903	Shub-el-Kono School ..	—	8,000	1,523	9,669	—	L. Fumeroli.
2		23-4-903	Saïd School ..	1-9-901	31,500	8,958	8,353	13-6-904	E. Antonon.
3		—	Zagazig Workshop ..	—		62,611	58,871	—	
<i>Prisons.</i>									
F—			Zagazig Laundry and Kitchen ..	—	—	—	—	—	Ghezso & Rodrigo.
1		5-9-903	Zagazig Block E, Latrines ..	—	—	—	—	—	Do.
2		25-6-903		—	—	1,726	3,177	—	
3		—		—	—	—	—	—	

Appendix 3

CHIEF INSPECTION SPECIAL BUILDINGS.

LIST A. — WORKS TAKEN OVER DEFINITELY DURING 1903.

Order.	Administration	Name of Work.	Date of completion.	Sanction for works.	Cost exclusive of Architects' charges.	Name of Contractor.
A.	<i>General.</i>			£ R.	£ S.	
1		Egyptian Museum Residence for Director General ..	20-10-002	4,400	4,600	Giarozzo & Zulfarani.
2		Egyptian Museum Police Quarters	20-12-002	850	738	Giarozzo & Zulfarani.
3		Arab Museum & Khedivial Library	16-3-002	57,142	55,815	Marash & Tréhaki.
4		Boulae Stables	22-6-002	10,000	8,970	Zulfarani, Amigoni and Gandolfi.
5		Tanta Town Office	4-6-002	2,000	1,902	Margessoff Bey.
6		Model Workshop	15-10-002	11,083	10,924	Tréhaki.
B.	<i>Interior.</i>					
1		Police Barracks Nawa ..	1-7-002	2,800	2,540	Ali Badawi.
C.	<i>Justice.</i>					
1		Cairo Native Court of Appeal Archives	5-8-002	2,140	1,900	N. Marchand.
2		Port Said Summary Law Court	20-12-002	1,250	1,386	Goëtin & Charvaut.
D.	<i>Education.</i>					
1		Addition of 3 rooms to Abbas School	20-9-002	650	641	Zamam, Amigoni and Gandolfi.
E.	<i>Prisons.</i>					
1		Block 4 and Laundry, Manshia Prisons	1-5-002	—	15,116	N. Prosperi.
2		Zagazig Hospital	1-9-002	—	1,273	Ghezso & Rodrigo.

Appendix 4.
SPECIAL BUILDINGS, LOWER EGYPT.

TABLE SHOWING COST PER METRE SQUARE AND METRIC CUBE OF BUILDINGS TAKEN OVER FINALLY IN 1903.

No.	Name of Work.	Town.	Total cost exclusive of Architects	Surface covered.	Volume.	Cost per M ² .	Cost per M.	Description.
			L.E.	M ²	M ³	L.E. M.	L.E. M.	
1	Arab Museum & Khedivial Library..	Cairo..	55,815	3,916	97,610	11 275	0 572	Part basement ground floor, 1st floor and 300 M ² 2nd floor.
2	Residence of Director General Egyptian Museum	Cairo..	1,616	383	6,015	12 052	0 767	Basement, ground floor 1st floor and 100 M ² 2nd floor.
3	Police Quarters Egyptian Museum..	Cairo..	738	203	1,583	3 635	0 166	Single storey.
4	Police Stables.. .. .	Cairo..	8,970	1,170	9,210	6 102	0 971	Single storey and boundary wall
5	Tanzim Office.. .. .	Tanta..	1,766	171	1,880	10 327	0 939	Ground floor, 1st floor verandah 56 M ²
6	Model Workshop Building	Cairo..	10,611	2,628	21,126	4 019	0 436	Single floor, steel trussed roof over 185 M ² .
7	Police Barracks	Nawa ..	2,521	550	1,670	4 589	0 511	Ground floor, and 154 M ² 1st floor.
8	Addition of 3 rooms to Abbas School	Cairo..	611	187	936	3 128	0 685	Rooms 5 metres high.
9	Archives for Native Court of Appeal	Cairo..	1,900	507	3,524	3 717	0 539	Single storey
10	Summary Law Court	Port Said..	1,297	655	1,290	6 560	1 016	Single storey.

N.B.—The heights for calculating the volumes are measured as follows —

From halfway between ground level and bottom of foundation, or where there is basement from half way between basement floor and bottom of foundation to roof level, neglecting parapet for flat roofs, or to half way up slope of sloped roofs.

Wooden verandahs, sheds, etc., are ignored in calculating the volumes, though their cost is included.

Appendix 5.

GENERAL STATEMENT OF NEW BUILDINGS

EXCLUDED

WITHIN A PERIOD OF 8 YEARS COMPRISED BETWEEN 1896-1905.

LARGE BUILDINGS.

	L. E.	M.
Museum of Egyptian Antiquities (Constructions and Sundries)	256,521	—
Arab Museum and Khedivial Library (Price of land and furniture not included)	51,300	—
Native Court of Appeal, Governorate and Mixed Prison (Price of land and furniture not included) ...	92,000	—
Total... ..	399,821	—

SCHOOLS.

	L. E.	M.
Assuan	2,515	—
Cairo (Model Workshop)	14,250	—
.. (Nasrîeh School)	29,958	—
.. (Abbas School)	7,256	—
.. (School of Girls) Teachers' house	789	—
Chibin-el-Kom	8,000	—
Damiatta	1,108	—
Damanhour	776	—
Esneh	5,826	—
Guizeh (Agricultural School)	21,450	—
Minieh	4,293	—
Port-Saïd	4,300	—
Total... ..	100,521	—

TRIBUNALS.

	L. E.	M.
Ayat and Port-Saïd	7,000	—
Chibin-el-Kom	3,335	—
Dessouk... ..	1,481	—
Helia (Mehkémé Charieh)	462	—
Minieh et Mehalla	3,630	—
Sedfa	1,387	—
Sohag	2,412	—
Total... ..	19,737	—

HOSPITALS.

	L. E.	M.
Lunatics' Asylum, Cairo	15,500	—
Alexandria (infectious diseases)	5,000	—
Assiut	10,908	—
Benha	1,854	—
Beni-Suef, Damanhour and Fayum... ..	12,000	—
Cairo (enlargement Kas-el-Aini Hospital)	25,350	—
Cairo Bacteriological Laboratory, at the Hospital of Kas-el-Aini	978	—
Cairo (local vaccin. Abbassieh)	424	—
Chibin-el-Kom	5,070	—
Minia	7,500	—
Man-sourah	1,249	—
Port-Said	7,500	—
Sohag	4,000	—
Suez	8,000	—
Tanta	4,050	—
Works executed by Sanitary Service in 1903	9,000	—
Total... ..	<u>118,392</u>	—

DISINFECTION STATIONS.

	L. E.	M.
Damietta	—	—
Man-sourah	—	—
Zagazig	3,145	—
Tanta	—	—
Suez	—	—
Total... ..	<u>3,145</u>	—

SLAUGHTERHOUSES.

	L. E.	M.
Beni Suef	1,754	—
Benha	582	—
Beba	485	—
Cairo	6,334	—
Chibin-E-Kom	513	—
Damanhour	1,832	—
Damietta	841	—
Fayum	2,003	—
Guizeh	202	—
Guirguch	564	—
Helouan	716	—
Kallub	534	—
Kena	838	—
Carried forward	<u>17,198</u>	—

	L. E.	M.
<i>Carried forward</i>	17,198	—
Kafr-El-Zayat	559	—
Luxor	569	—
Mit Glamr	642	—
Menouf	684	—
Minieh	1,635	—
Magazah	346	—
Mehallah	788	—
Mellatou	521	—
Manfalout	835	—
Port-Said	1,904	—
Suez	1,100	—
Shahag	673	—
Senoutés	405	—
Tahta	831	—
Zifta	600	—
Reserve	5,469	—
Work executed on Sanitary Service 1901-1902-1903 (3 × 5,000)	15,000	—
Total... ..	<u>49,759</u>	—

GOVERNORATES, MUDIRIEHS AND MARKAZ.

	L. E.	M.
Port-Said (Governorate)	18,000	—
Galioubieh (Mudirs' house)	1,627	—
Fayum (Annex to Mudirieh)	494	—
Kenah (Mudirieh)	1,000	—
Alexandria, Police Barracks: Quay	1,783	—
" Moharrem Bey Caracol	758	—
" Fleming Caracol	2,695	—
Atf.—Police Station	710	—
Abnub.—Markaz... ..	1,822	—
Aboujerkas	1,698	—
Achmoun	1,731	—
Badari	1,689	—
Beba	2,034	—
Belbeis	3,572	—
Baltim	784	—
Beni-Suef	6,500	—
Cairo.—Caracol Darb El Ahmar	3,000	—
" " Pyramids... ..	1,343	—
" " Sayeda Zenab	617	—
" " El Wayli	656	—
Choubrakhit Markaz	1,651	—
<i>Carried forward</i>	<u>54,164</u>	—

	L. E.	M.
<i>Forward</i>	54,164	—
Dessuk	1,894	—
Deirut	2,329	—
Delingat	1,986	—
E-sa	3,704	—
Etsa	1,701	—
Facous	1,130	—
Guirga	1,080	—
Gnizeh	2,884	—
Kolosna	1,807	—
Kouesna	1,645	—
Kallub	1,714	—
Kom-Hamada	2,846	—
Manfalut	1,682	—
Minia	2,478	—
Nawa	3,347	—
Sembellawein	1,751	—
Sennoures Markaz	1,604	—
Tahta	1,748	—
Toukh	1,564	—
Zefta	1,648	—
Total... ..	94,706	—

PRISONS.

	L. E.	M.
Alexandria	24,245	—
Abouzabal	475	—
Beni-Suef	25,843	560
Cairo	43,061	440
Tanta	35,452	—
Toura	2,000	—
Zagazig	11,385	—
Works executed by Prisons in 1903	20,000	—
Total... ..	162,462	—

CUSTOM-HOUSES AND COAST-GUARDS.

	L. E.	M.
Alexandria.—Tobacco Stores	37,223	—
.. Sundry Custom-Houses and Coast-Guards	38,274	—
Damietta.—Custom-House	4,878	—
Ismailia.—Custom-House	780	—
Port-Ibrahim.—Custom-House... ..	923	—
Port-Said and Kantara	1,865	—
Port-Said petroleum Stores	2,530	—
Port-Said Coast Guard Barracks	1,339	—
Suez.—Custom House	3,131	—
Works executed by Custom Houses in 1903	7,500	—
Total... ..	101,446	—

QUARANTINE STATIONS.

	L. F.	M.
Alexandria.—Mex	9,118	—
Gabal El Tor	41,721	—
Port-Tewfik	874	—
Total... ..	51,713	—

POST OFFICES.

	L. F.	M.
Alexandria.—Annex	665	—
Abou-Kébir.—Annex	388	—
Cairo.—Enlargement	14,509	—
Ebcheway	457	—
Man-urah	773	—
Port-Said	24,552	—
Total... ..	41,344	—

TANZIM OFFICE.

	L. F.	M.
Damanhour... ..	1,227	—
Tanta	1,902	—
Sohag	3,396	—
Total... ..	6,525	—

SUNDRIES.

	L. F.	M.
Annex Ministry of Justice Sundries p.c.	874	—
.. Sanitary Service	1,497	—
.. Caisse de la Dette	2,100	—
Survey Department.—Guizeh	1,057	—
School of Agriculture (dairy and stables)	2,500	—
Zoological Gardens, Guizeh (2 pavilions)	1,500	—
.. .. (pavilion for large animal-)	1,898	—
.. .. (cage for animal-)	4,000	—
Local for reproduction of plans	2,655	—
Port-Said Lazaret	3,000	—
Local Photographies	581	—
House for Director of School of Medicine	2,340	—
.. .. of Zoological Gardens	713	—
Museum of Society of Geography	951	—
New Geological Museum	4,602	—
Firemen's Central Station, Cairo	18,675	—
New stables, Cairo	6,000	—
Total... ..	54,943	—

RECAPITULATION

	L. E.	M.
Large buildings, Museums and Courts of Justice ...	399,821	—
Schools	100,521	—
Tribunals	19,737	—
Hospitals	118,392	—
Desinfection Stations	3,145	—
Slaughterhouses	49,759	—
Governorates, Mudirihs and Markaz	94,706	—
Prisons	162,462	—
Custom-Houses and Coast-Guards	101,446	—
Quarantine Stations	51,713	—
Post-Offices	41,344	—
Tanzim Offices	6,525	—
Sundries	54,943	—
	<hr/>	
GRAND TOTAL... ..	1,204,514	—
	<hr/> <hr/>	

Appendix 6.

INSPECTION.	TOTAL NUMBER OF BUILDINGS REPAIRED.	TOTAL SPENT ON				GRAND TOTAL SPENT	
		ORDINARY BUDGET		SPECIAL CREDIT			
		L. E.	M.	L. E.	M.	L. E.	M.
East... ..	92	3,771	835	3,115	—	6,886	835
West	170	5,112	369	25,467	000	30,579	369
Cairo Buildings ...	47	7,383	000	7,002	000	14,385	000
Delta Buildings ...	18	1,407	000	...		1,407	000
				Total L.E....		53,258	204

Appendix 7.

TABLE OF PRIME COST OF NEW SMALL BUILDINGS EXECUTED IN 1903.

Number.	Description of buildings.	Number of floors.	Total price.	Surface covered.				Verandahs.			Enclosure walls.		Buildings with dwarf walls.		Stables, etc.	Volume.	Price per m.c.
				Without courtyard.	Without verandahs.	Surface.	Price.	Length.	Width.	Surface covered.	Price per M. Sup.	Volume per M.	Weight per M.	Price per M.			
			L.E.	L.E.	L.E.						L.E.				L.E.	M ³	L.E.
1	CAIRO. Construction of a sorting room on the 1st floor of the new addition at the Post Office ...	1	580	M ² 200	M ² 200	200	2,900	—	—	—	—	—	—	—	—	1,200	0.180
2	Enlarging the general store rooms of the Printing house ...	R. d. Ch. et Per étage.	520	M ² 95	M ² 5,580	93	5,580	—	—	—	—	—	—	—	—	1,000	0.520
3	Construction of a room over the 1st floor of the Chemical Laboratory ...	1	800	M ² 240	M ² 3,033	240	3,033	—	—	—	—	—	—	—	—	1,320	0.600
4	Construction of a marquisé at the main entrance of the Opera House ...	—	117,000	117,000	—	—	—	M. 3,530	M. 3,000	M ² 32,000	1,000	—	—	—	—	—	—
5	DELTA. Construction of a room for the fire engine at Dessouk ...	R. d. Ch.	83	20	—	—	—	—	—	—	—	—	—	—	—	M ² 119	0.700

Appendix 8.

MINISTRY OF JUSTICE

LIST OF MAHKAMAS EL-MARKAZ EL-SHARIYAH IN UPPER EGYPT.

MaHKamas-el-Markaz El-Shariyah.	Government property or Rented.	MaHKamas-el-Markaz El-Shariyah	Government property or Rented.
Embabeih	Government.	El-Saf	Rented.
Ayat	Rented.	Guizeh ... ..	..
Beni Suef ... ..	..	Bebeli ... ..	..
Wasta	Government.	Sennoures ... ..	..
Fayum	Rented.	Et-sa ... ..	..
Minieh ... ..	..	Fachn ... ..	..
Magaga ... ..	..	Beni-Mazar ... ..	..
Abou Korkas... ..	..	Samalut ... ..	..
El-Wahal-el-Bahariyah..	..	Manfalut	Government.
Abu Tig	Government.	Mallawi ... ..	..
El-Wahal-el-Dakileh ...	..	El-Wahal-el-Khariga ...	..
Tahta	Rented.	Deirut	Rented.
Badari ... ..	..	Assiut ... ..	..
Abnub ... ..	..	Baliana ... ..	..
Suhag ... ..	..	Akmime ... ..	..
Guirguch	Government.	Dechna... ..	Government.
Kosseir ... ..	..	Esneh	Rented.
Keneh	Rented.	Luxor ... ..	..
Nag Hamadi ... ..	..	Kons ... ..	..
Edfu	Government.	Aswan... ..	..
Korosko	Rented.	Abi-Hore ... ..	..

Appendix 9.

MAINTENANCE OF TOWN ROADS FROM 1902 TO END 1903.

Towns.	YEAR.	Water	Lighting.		Roads and Gardens.	Sundries	TOTALS.	BUDGET.
		L. E.	L. E.	M.	L. E.	L. E.	L. E.	L. E.
<i>Direction Delta</i>								
Tanta	1902	358	539	..	1,129	78	2,106	2,500
	1903	615	540	..	1,207	290	2,653	
Kafr-el-Zayat ...	1902	37	186	..	571	..	795	1,000
	1903	37	320	..	596	..	954	
Mehalla	1902	29	382	..	569	38	1,018	1,200
	1903	29	388	..	578	1,391	2,387	
Zefta... ..	1902	38	475	..	519	24	1,058	1,200
	1903	38	475	..	879	47	1,440	
Chébin	1902	39	412	..	652	69	761	1,500
	1903	39	447	..	661	10	711	
Menouf	1902	19	148	..	327	55	549	1,200
	1903	20	82	..	320	72	494	
<i>Direction East</i>								
Suez... ..	1902	50	700	..	1,140	309	2,200	2,200
	1903	50	700	..	1,155	294	2,200	
Damietta... ..	1902	..	299	997	490	..	789	1,500
	1903	..	256	706	886	..	1,143	
Zagazig	1902	..	416	..	1,217	987	2,620	2,250
	1903	70	419	020	1,337	752	2,578	
Man-sourah ...	1902	55	900	..	181	..	1,137	2,750
	1903	55	900	..	181	..	1,137	
Port-Said... ..	1902	..	..	000	..	..	..	3,878
	1903	245	2,505	996	4,127	..	6,878	
Mit-Ghamr ...	1902	..	..	..	14	..	46	1,200
	1903	..	..	..	15	..	78	
<i>Direction West</i>								
Damanhour ...	1903	295	..	..	871	18	1,185	1,500
Benha	1903		181	451	683,271	..	864,722	1,000

Appendix 10.

SUMS GRANTED TO LOCAL COUNCILS SINCE THEIR CREATION IN 1894 TO 1903.

Towns.	1894	1895	1896	1897	1898	1899	1900	1901	1902	1903
<i>Direction Delta.</i>										
Tanta	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Kafr-el-Zayat	—	—	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Mehalla el Kebir	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
Zifta	—	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
Chilim-el-Kom	—	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Menouf	—	—	—	—	—	—	—	1,200	1,200	1,200
<i>Direction East.</i>										
Zagazig	2,250	2,250	2,250	2,250	2,250	2,250	2,250	2,250	2,250	2,250
Suez	—	1,877-151	2,200	2,200	2,200	2,200	2,200	2,200	2,200	2,200
Damietta	—	—	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Mit-Gamr	—	—	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
Mansourah	2,750	2,750	2,750	2,750	2,750	2,750	2,750	2,750	2,750	2,750
<i>Direction West.</i>										
Damanhour	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Benha	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000

Appendix 11.

TANZIM ROKHSAS DELIVERED IN 1902 & 1903.

Years.	Towns.	for Buildings and Repairs	for Occupation of the public road	for Verandahs	Totals.	Receipts.	
						L.E.	M.
<i>Direction Delta.</i>							
1902 } 1903 }	Tantah }	310 391	718 786	11 20	1079 1197	603 923	402 264
1902 } 1903 }	Kafr-el-Zayat ... }	70 97	140 127	2 4	212 228	107 114	092 050
1902 } 1903 }	Mehalla }	282 327	244 204	— —	526 531	191 214	770 480
1902 } 1903 }	Zifta }	113 121	74 79	— —	187 200	82 71	785 700
1902 } 1903 }	Chibin... .. }	176 231	52 79	22 26	250 336	72 111	840 140
1902 } 1903 }	Menouf }	151 218	32 67	7 7	190 292	60 192	795 275
<i>Direction East.</i>							
1902 } 1903 }	Zagazig }	264 309	149 272	23 22	436 603	198 331	810 685
1902 } 1903 }	Mansourah... .. }	285 331	350 294	24 21	659 646	419 285	394 234
1902 } 1903 }	Suez }	93 105	174 149	2 2	269 256	121 122	318 781
1902 } 1903 }	Port-Said }	— 286	— 551	— 103	— 940	— 362	— 677
1902 } 1903 }	Ismailieh }	— 40	— —	— 3	— 43	— 12	— 460
1902 } 1903 }	Damietta }	244 225	066 78	3 7	313 310	117 122	336 438
1902 } 1903 }	Mit-Gamr }	498 241	122 93	— —	620 334	145 124	132 839
<i>Direction West.</i>							
1902 } 1903 }	Damanhour ... }	269 249	79 107	8 26	356 401	114 156	900 481
1902 } 1903 }	Rosetta }	78 195	— —	6 5	84 200	20 26	220 160
1903	Benha... ..	100	85	9	194	89	728

Appendix 12.

EXPROPRIATION AND SALE OF ZIADET TANZIM, 1902-1903.

Years	Towns.	EXPROPRIATION.			ZIADETS SOLD		
		Areas.	Sums paid.	Rate of M ²	Areas	Sums received.	Rate of M ²
			L. F. M.	L. F. M.	M ²	L. F. M.	L. F. M.
<i>Direction Delta.</i>							
1902 } 1903 }	Tantah ... }	51.78 59.36	155.014 137.015	3.009 2.308	303 37	— 25.625	— 0.685
1902 } 1903 }	Kafr-el-Zayat ... }	— —	— —	— —	— —	— —	— —
1902 } 1903 }	Mehalla Kobra }	— —	— —	— —	172 267	36.000 110.000	0.209 0.524
1902 } 1903 }	Zifta ... }	— —	— —	— —	269 118	— 3.175	— 199
1902 } 1903 }	Chibin-el-Kom }	494.14 383.03	179.866 158.331	0.364 0.413	221 26	28.457 14.578	128 257
1902 } 1903 }	Menouf ... }	28.25 —	9.079 —	0.321 —	46 88	11.333 25.000	242 283
<i>Direction East.</i>							
1902 } 1903 }	Zagazig ... }	98.87 372.76	68.875 141.348	0.696 0.378	69 298	68.683 229.968	0.981 0.769
1902 } 1903 }	Man-ourah ... }	1246.00 1425.14	225.094 443.425	0.180 0.311	46 127	38.350 86.190	0.829 0.674
1902 } 1903 }	Suez ... }	2.80 23.32	0.840 4.944	0.300 0.212	0 23	0 0 9.065	0 0 0.379
do.	Port-Said ...	(Néant)					
1902 } 1903 }	Damietta ... }	107.19 183.66	15.557 42.288	0.145 0.230	582 810	48.644 101.216	0.083 0.124
1902 } 1903 }	Mit-Ghaur ... }	00.00 2796.10	0 0 121.107	0 0 0.248	158 108	Prix inconnu Registre à la Moud.	
<i>Direction West.</i>							
1902 } 1903 }	Damanhour ... }	18.06 37.25	4.265 15.666	0.230 0.420	308 608	62.992 516.832	0.204 0.849
1902 } 1903 }	Rosetta ... }	51.34 232.67	2.053 6.980	0.041 0.030	111 493	3.331 14.816	0.030 0.030
1903	Benha ...	335.595	194.826	0.580539	26.71	21.118	0.790640

Appendix 13.

LIGHTING AND SUPPLIES.

TOWNS.	Area of road lighted	Kind of lighting.	Number of lanterns.	Cost per lantern.	Annual cost of lighting total.	Annual cost of lighting per inhabitant.	Sanitary Budget.	Sanitation expenses per inhabitant.	Reserve Fund.	Purchase of Zaidet-Tanzim	Cost of Administration.
	M2			L.E.	L.E.	L.E.	L.E.	L.E.	L.E.	L.E.	L.E.
<i>Direction Delta.</i>											
Tanta...	166137.332	Petroleum.	339	1.598	540	0.009434	365	0.006381	—	137.015	2,500
Kafu-El-Zayat ...	72000.215	"	170	1.883	320	0.3129	100	—	—	2.091	569
Mehadia Kachira...	100000	"	190	2.105	100	0.0125	100	0.003	1100	—	2,387
Zefra ...	89500	"	100	1.75796	175	0.033478	81	0.007123	379.120	50.000	750
Chelbin-El-Kom ...	68822	"	75	5.9636	117	0.0216	150	0.00131	122.104	11.578	942
Menouf ...	32601	"	35	2.311	82	0.0039	100	0.00107	77.728	25.000	191
<i>Direction East.</i>											
Suez ...	190167	Mineral Oil	135	5.185	709	0.010	200	0.011	71.400	9.083	2,200
Port-Saïd ...	121700	Gas ...	342	7.327	2,505	0.019	—	—	—	—	111
Zagazig ...	270000	Petroleum.	202	2.100	121	0.012	200	0.003	330.956	229.968	258
Mansourah...	335038	Electricity.	420	2.002	898	0.024	—	—	—	—	27
Damietta ...	180000	Petroleum.	315	0.741	256	0.008	150	0.001	316.123	30.000	—
Mit Ghamr...	60000	"	160	2.125	388	0.025	100	0.006	37.000	108.860	—
<i>Direction West.</i>											
Damanhour...	70000	Petroleum.	180	1.682	303	0.009122	150	0.00165	100	6.540	—

Appendix 14.
WATER RAISING MACHINERY,—(COST OF WATER, 1963.

TOWN.	Population	Total Budget	Hours Work of Pump	Pumping Water in Inches	Total lift in ft.	Approx. Q. litres per sec.	W.H.P. or E.H.P. lifts × metres	Q. M ³ lifted per hour	COST IN MILLIKMAS PER HOUR OF					Cost per cu. m. of water	Cost per cu. m. of water	Number of inhabitants that can be supplied with drinking and house water at 20 litres a head 10 hours a day by present pump
									Petroleum.	Waste cotton	Lubricants.	Driver's Wages	Leak			
<i>Direction du Delta.</i>																No.
Tanta ...	57289	2,500	—	—	—	—	—	—	—	—	—	—	—	—	—	57289
Kafr ElZayat	10231	1,000	4	3	5 ^m . 14	1.944	0.432	7	3.20	0.086	0.24	10	13.50	1.93	103.84	35000
Mehalla ...	31791	1,200	2	6	13. 18	7.220	1.270	26	8.240	—	2.040	8.300	18.550	0.713	11.000	13000
Zifta ...	14039	1,200	5	3	9. 75	1. 72	0.613	17	6	2.5	2	16.66	27.1	1.59	11.208	—
Chelone ...	20705	1,500	3	3	11. 00	5. 55	0.844	20	18	2.5	2	10.00	32.5	1.65	30.000	10000
			3	3	2. 51	1.111	0. 37	40	13.860	0.648	0.621	13.33	28.462	0.711	76.924	35000

(1) Quantity of water pumped 114,750 litres per day.
(2) Machine of 100 H.P.
(3) Machine of 100 H.P.

Appendix 15.

DUTIES OF THE DISTRICT TANZIM ENGINEERS.

For P. W. D. Tanzim.—Permits, plans, contraventions, alignments, expropriation, estimates examination of insecure houses.

Technical Service.—Plans of engine installations.

Finance.—Sale of land, plans, survey and handing over.

Local Commissions.—Projects, roads, levelling, lighting, watering, gardens, waterworks, tramways, telephones.

Sanitary.—Cemeteries, choice of survey.

Appendix 16.

SOME CHARACTERISTICS OF LOCAL BRICKS

TABLE I.

RATE OF ABSORPTION OF BRICKS.

CLASS OF BRICKS.	Percentage of water (by volume) absorbed after immersion during							
	1 Minute	3 Minutes	5 Minutes	10 Min.	½ Hour	1 Hour	24 Hours	48 Hours
Zaffrani	27.99	32.71	33.07	33.10	33.18	33.25	34.45	—
Mieli... ..	14.16	14.74	14.97	15.15	15.46	15.79	17.87	—
Tanzim	22.12	23.40	23.49	23.57	23.83	23.93	26.87	27.39
Bircher (Ordinary)...	17.04	26.47	30.92	32.15	32.40	32.45	33.26	33.59
.. (Machine)...	6.76	12.29	15.55	19.21	24.10	26.34	27.01	27.18

TABLE II.
ABSORPTION.

CLASS OF BRICK.	Percentage of water absorbed by volume.				Percentage of water absorbed by weight.			
	Experiment A	Experiment A	Experiment B	Mean	Experiment A	Experiment A	Experiment B	Mean.
Zaffrani	34.80	33.54	34.45	34.26	22.66	21.85	22.89	22.47
Mieli... ..	17.92	16.37	17.87	17.39	10.85	9.92	10.34	10.37
Tanzim	23.10	20.63	27.39	23.71	16.19	14.46	19.03	16.56
Bircher (Ordinary ...	35.46	34.43	33.59	34.49	22.47	21.82	21.12	21.80
.. (Machine)... ..	24.42	27.70	27.18	26.43	13.33	15.12	15.76	14.74

TABLE III.

CLASS OF BRICKS.	Weight of 100 Bricks dry Kgs.	Cube of 100 Bricks M ³	Weight of Bricks per M ³ dry Kgs.	Volume of water absorbed by M ³	ABSORPTION.	
					Percentage of Weight	Percentage of Volume.
Zaffrani	191.87	0.125	1535	0.043	22.47	34.26
Bircher (Ordinary) ...	203.58	0.128	1584.3	0.045	21.80	34.49
.. (Machine)	220.83	0.121	1831.3	0.031	14.71	26.43
Tanzim	234.75	0.164	1427	0.036	16.56	23.71
Mieli	198.13	0.120	1651	0.021	10.37	17.39

TABLE IV.

GENERAL CHARACTERISTICS OF BRICKS.

CLASS OF BRICKS.	Weight of Bricks per M ³ dry Kgs.	Specific Gravity.	ABSORPTION.		CRACKING LOAD. Kgs per Cm.
			% of Volume.	% of Weight.	
Zaffrani	1535	2.3	34.26	22.47	13.85
Mieli... ..	1651	2.1	17.39	10.37	12.58
Tanzim	1427	1.9	23.71	16.56	8.29
Bircher (Ordinary)...	1584.3	2.4	34.49	21.80	72.17
.. (Machine)...	1831.3	2.4	26.43	14.74	104.46
Marsili	—	—	—	—	29.59

TABLE V.

RESULTS OF INDEPENDENT TESTS.

CLASS OF BRICKS	Weight of 100 Bricks dry Kgs	Cube of 100 Bricks M ³	Weight of Bricks per M ³ dry Kgs	Volume of water absorbed by 100 bricks.			ABSORPTION.	
				1st Test M ³	2nd Test M	Mean. M ³	Percent- age of Vol. %	Percent- age of Weight %
Zaffrani	189	0.120	1575	0.040	0.0432	0.0416	34.7	22.03
Bircher (Ordinary ...	205	0.130	1577	0.045	0.047	0.046	35.38	22.44
.. (Machine)...	—	—	—	—	—	—	—	—
Tanzim	233	0.160	1456	0.045	0.040	0.0425	26.56	18.24
Miel... ..	195	0.120	1625	0.030	0.030	0.030	25	15.32

TABLE VI.

CHARACTERISTICS OF ENGLISH BRICKS.

CLASS OF BRICKS.	Weight per M ³ dry.	Specific Gravity	Absorption Percentage of Weight.	Cracking Stress.	Crushing Stress.	REMARKS.
	Kgs.			Kgs. per cm ² .	Kgs. per cm ² .	
Bricks weak red	2002	—	—	38.67	—	Bankine's civil Engineering.
Bricks strong	to	2 to 2.17	—	56.25 77.34	—	Mitchell's Building Construction.
Brick fire	2163	—	—	119.53	—	
Unburnt Bricks	—	—	—	4.02	36.21	Grant.
Common Red	1894.7	—	—	25.19	151.16	Latham.
Machine-made / Formed Red \	—	—	—	86.83	124.59	Latham.
Common Stock	1843.3	—	10.5	43.78	560.37	Latham.
Fareham Reds	1901.6	—	—	36.59	113.41	Grant.
.. Rubbers	1605.4	—	—	4.49	50.41	Grant.
Gault	—	—	—	53.57	148.97	Grant.
.. Wire-cut	—	—	—	29.10	149.62	Grant.
.. Pressed	—	—	—	31.67	157.49	Grant.
Stafford dressed Blue...	—	—	—	60.02	441.47	Latham.
..	—	—	—	86.33	293.12	Latham.
.. Common Blue...	—	—	—	50.08	150.25	Latham.
Bishops Waltham Wire- cut	—	—	—	124.74	189.09	Bramwell.
Burham Wire-cut	1671.3	—	19.0	—	212.62	—
.. Pressed	1701.7	—	19.5	—	193.72	—
Wire-cut White Gault..	1645.2	—	19.0	—	212.62	—

Appendix 17.

Tableau de comparaison entre les prix de revient des planchers en béton armé et planchers avec solivage en bois ou en fer.

Les calculs des planchers ont été faits en prévision d'une surcharge de 300 Kgs. par mètre carré et les prix de revient faits pour une bande de 1.00 mètre de largeur et de toute la portée de la pièce.

Les prix unitaires qui ont été appliqués pour établir les prix de revient sont :

1° Pour plancher composé de solives en bois, faux plancher et natte (Prix de l'entreprise de l'Ecole Sanieh).

2° Pour plancher composé de solives en fer entrevous en briques creuses à plat et béton de remplissage jusqu'au niveau de la semelle supérieure des solives (Prix de l'entreprise de l'Ecole de Droit).

3° Pour plancher en béton armé composé seulement du hourdis et de poutres pour les grandes portées (Prix de l'entreprise de la Caserne des Pompiers).

PORTÉE	SURFACE DL PLANCHER	PRIX DE REVIENT DES PLANCHERS					
		avec solives en bois.		avec solives en fer.		en béton armé.	
M.	M ²	L.E.	M.	L.F.	M.	L.E.	M.
3	3	0	762	0	832	1	500
4	4	1	259	1	325	2	000
5	5	1	961	2	023	2	500
6	6	2	857	3	264	3	000
7	7	3	450	4	565	4	620
8	8	4	672	6	192	5	280
9	9	6	131	8	602	5	940
10	10	7	446	11	555	6	600
	52	28	538	38	358	31	440
Prix moyen du M ² ...		28.538 — 52 — L.E.0.549		38.358 — 52 — L.E.0.738		31.440 — 52 — L.E.0.605	

CAIRO VOIRIE

CAIRO ROADS

Total area square metres	2,831,077
	<u>Sq.M.</u>
Roads well macadamised	450,606 16.5%
" " asphalted	15,562
Inferior macadam	974,870 34.5%
Earth roads	1,390,039 49.0% 100%
Total	<u>2,831,077</u>

Spent in upkeep, square metres 490,956, roads or 17%	L. E.
total at rate of 24.9 Milliemes	12,229
Spent on asphalt roads on special grant... ..	17,305

83% of the streets of Cairo are not maintained at all, owing to want of funds. The public complain that, though the progressive increase of the house-tax from 1895 to 1902 amounts to 41.5%, the budget for road maintenance has only received an addition of 3.86%.

The roads budget for Alexandria in 1903, with a population of 320,000, amounted to L.E. 30,800.

Cairo, with a population of 570,000, can with difficulty devote L.E. 14,000 annually to the same object. I am not taking into consideration the incidental grant of L.E. 20,000 for asphalt.

This latter grant only suffices for approximately two kilometres out of a total length of 283 kilometres of road.

Assuming the population of Cairo at 600,000
and the number of houses at 65,000
a tax of Milliemes 283 per head, or L.E. 2.610 per house, would furnish sufficient funds to pave all the streets of Cairo in 10 years (Vide statement cost.) After 10 years the first cost would be covered and the tax could be reduced so to cover maintenance only, viz. to per head Milliemes 132, per house L.E. 1.217.

Appendices
C. D. E.

		<u>L.E.</u>	
First cost construction...	{ Roads	684,035	
	{ Trottoirs..	221,345	
		<u>905,380</u>	L.E.
Cost of annual repairs...	{ Roads	67,235	
	{ Trottoirs..	11,865	
		<u>79,100</u>	
Total cost of plant... ..		15,000	
		<u>999,480</u>	
		<u>L.E.</u>	
Real cost annual repairs		79,100	
Sum allotted 1904		16,000	

TANZIM AND VOIRIE.

Appendices
C D E

I would draw special attention to the statement showing the striking disparity between the funds allotted and required for road construction and maintenance. It is interesting to note that the Ghezireh Hotel Company charge householders on their estate an annual tax of 240 P.T. for scavenging and watering only, whereas, as estimated above, an additional house-tax of L.E. 2.610 Milliemes would provide funds to construct and maintain the whole road area of Cairo.

I have, as usual, reduced to a tabular form the result of the year's work.

Denomination of } 2,189 nameplates for roads and
roads and num- } 3,358 house numbering plates were ordered in
bering of house. } 1903. They will be fixed in 1904.

Appendix A

The Kasr-el-Nil Square and approaches and the Mariette road leading to the Museum were remodelled and considerably widened in 1903. The total cost came to L.E.1,739. Of this sum L.E. 1,000 was furnished by the Tramway Co. in consideration of a permit to lay a new line round the Mixed Tribunal and to double the track along the Mariette road.

RAIN DRAINS.

These have worked well. The upkeep of these drains costing L.E.735 has come as a new expense on our budget and, until a special grant is made, will cause a diminution in the area of road maintained.

The expenditure of the L.E. 735 is detailed as follows:—

	L. E.
Sewermen, maximum 30, minimum 11; average of the year 21 per day, costing, night work included	352
Masons	12
Water-cart for removing water from decantation mouths... ..	148
Carts for various transports	43
Supervision	98
Water for drain washing cubic metres 127	1
Various purchases.	50
Electricity 810 kilowatts \times 0.038575=	31
Total..	<u><u>L.E. 735</u></u>

The work executed comprises:

Removal of dirty water from the drain mouths by "fantas-es"	2354
Removal of mud from the drains and mouths	927
Water pumped	51140
Time for pumping this water	45 hours
Electricity consumed by the motor pump	810kilowatts

In the above volume of 51,140 cubic metres of water pumped are included :—

(a)	Water for washing asphalted roads	... ..	350	M ³
(b)	.. ..	macadamized roads	... ..	90 ..
(c)	.. ..	drains...	... ..	127 ..

The price of water for (a) and (b) has been paid by the Sanitary Department and (c) by Tanzim Service.

The water at the mouths was removed by buckets.

A project for providing a further zone in Cairo with rain drainage at an estimate cost of L.E. 115,000 was prepared in this Office and submitted to the Sanitary Department on the 28th June 1903. No decision has as yet been arrived at. I would point out that a postponement of this question implies the adjournment of any further extension for the asphaltting of the native quarters, as streets cannot usefully be asphalted until they are drained. I am anxious that this fact should not be overlooked.

ARAB MUSEUM.

A small garden was laid out at the south angle of this building at a cost of L.E. 214 to prevent dust from rising into the Library windows.

EGYPTIAN MUSEUM GARDEN.

The laying out of this garden was completed in 1903 for a sum of L.E. 1,093, of which L.E. 590 represents filling and supply of vegetable earth.

The water installation comprising hydrants, cast iron and lead pipes accounted for L.E. 570.

CART SERVICE.

Fair progress has been made with the demolition and reconstruction of the old Tanzim Cart Service stables and offices.

L.E. 2,450 were spent on offices, stores, dépôts, etc.

In spite of bad foundations necessitating the use of short piles the rate per square metre for stores and offices only came to L.E. 5.431 and that for dépôts to L.E. 1.812.

ASPHALT STREETS.

Out of a grant of L.E.20,000, a sum of L.E.17,599 was spent on the asphaltting of 15,562 square metres of street. The rate per square metre for asphaltting alone, including maintenance for 20 years, is L.E. 1.

The extra 0.115 per square metre represents kerbing, kennelling, drain junctions, unforeseen work and supervision.

The cost of the best macadam, not including kerbing, etc., amounts on 20 years to L.E. 1.165 per square metre or L.E. 0.050 more than asphalt.

This represents on 20,000 square metres the area which it is proposed to asphalt annually, an economy of L.E. 1,000.

The Neuchatel Asphalt Co. have so far fulfilled their contract engagements expeditiously and loyally.

After placing every possible obstacle in the way of the contractor even going so far as to assault the workmen and defacing the freshly laid concrete, the public has hailed the accomplishment of the new roads with enthusiasm and petitions are being signed praying for considerable extensions.

I would draw special attention to the great assistance furnished by Mansfield Pasha, of the Police, and his assistants.

Without Police protection the work must have been stopped.

By the employment of a few thousand pounds on expropriation, sections of existing streets running in the same direction, but blocked by intervening buildings, could be coupled up and converted into main lines of traffic. No funds are granted for this purpose. Every year expropriation becomes more costly. I presume that in case of a severe epidemic in Cairo, the piercing of wide thoroughfares would form part of any extraordinary scheme of hygienic legislation. Under such circumstances economy could not be practised. By the expenditure of an annual sum under conditions permitting of careful estimation and leisurely bargaining, large economies could undoubtedly be effected.

STATEMENT SHOWING ROADS ASPHALTED IN 1903.

NAME OF ROADS.	AREA
	M ²
Bab-el-Bahr, Souk-el-Kachab, Souk-el-Zalat, Kharratine. ...	6314.40
Bein-el-Harat	1985.67
Darb-el-Boughladady, Darb-el-Wasseh, Chak-el-Teebane, Haret el-Khadra	1610.77
El-Kobeleh.	1721.18
Fouatyeh-Rouey..	2666.62
Sekket-el-Rouey.	757.12
El-Borg	505.85
Total... ..	15561.61

GUEZIREH GROTTO.

RECEIPTS.

478	Paying tickets at	L.E.0 050=L.E. 23 900
6480	Paying tickets at	„ 0 020= „ 129 600
208	Service... ..	— —
109	„ Abonnement „	— —
	Sale of 8 ticket books at.	„ 0 200= „ 1 600
7275	Total... ..	L.E.155 100

COMPARISON OF SIMILAR MONTH 1902-03 : 21ST NOVEMBER TO 31ST DECEMBER.

	1903		1902	
	N°	Amount.	N°	Amount.
		L.E. M.		L.E. M.
Paying tickets at L.E.0 050 ...	45	2 250	58	2 900
Paying tickets at „ 0 020 ...	505	10 100	536	10 720
Free	14	—	17	—
Total... ..	564	12 350	611	13 620

APPENDICES

A.—TANZIM ROKHSAS DELIVERED IN 1903 & 1902.

YEARS.	For buildings and repairs.		For occupation of public roads.		For verandahs.		TOTALS.	RECEIPTS.	
	Cairo.	Koubbeh and Matariéh	Cairo.	Koubbeh and Matariéh	Cairo.	Koubbeh and Matariéh		L.E.	M.
1903...	2,251	8	166	—	107	—	2,532	1,458	457
1902...	2,181	5	123	—	52	—	2,361	1,023	772

B.—EXPROPRIATION AND SALE OF ZIADET TANZIM.

YEARS.	EXPROPRIATIONS.			ZIADETS SOLD.		
	Areas.	Sums paid.	Price of M².	Areas.	Sums received.	Price of M².
1903 ...	1,696.24	1,106,815	0.652	1,252.36	923,361	0.737
1902 ...	1,566.30	999,452	0.638	685.47	401,528	0.586

C.—ESTIMATE COST CONSTRUCTION AND MAINTENANCE OF TOTAL ROAD AREA CAIRO.

CATEGORIES	Total area for which Taxes is responsible roads and footpaths		Per Category	Area at present maintained in		Total	Balance requiring pavement in		Cost of paving Nos. 8 and 9		Cost annual maintenance of 2 and 3			Cost plant for Macadam	No of Year Required to complete	
	New Quarters	Old Town		Macadam	Asphalt		Macadam	Asphalt	Macadam	Asphalt	New Quarters	Old Town	Macadam			Asphalt
1st Category	500,000	150,000	650,000	150,000	31,500	182,400	19,394	118,500	9,880	118,500	17,500	20 Years	15,000	10		
2nd "	350,000	246,000	596,000	x	x	x	350,000	246,000	70,000	246,000	12,258					
3rd "	100,000	97,630	197,630	x	x	x	100,000	97,630	20,000	97,630	3,500					
4th "	160,000	81,370	241,370	x	x	x	160,000	81,370	32,000	81,370	5,600					
5th "	600,000	550,000	1,150,000	x	x	x	600,000	550,000	230,000		10,250					
Total	1,710,000	1,125,000							361,880	513,500	79,100		15,000	10		
	2,835,000								1,150,000,380							

RECAPITULATION

Total cost construction		{ Road }		681,035	{	905,580
		{ Sidewalks }		221,345		
Total cost annual maintenance		{ Roads }		67,255	{	79,100
		{ Sidewalks }		11,805		
Total cost plant				15,000		15,000
Total L.E.				999,180		999,180
S. B.—For 1904 the Roads Budget equals		{ a) For Maintenance }		16,000	{	30,000
		{ b) For Asphalt }		20,000		
				L.E.		

D.—ESTIMATED TAX REQUIRED TO COVER 1ST COST & MAINTENANCE OF CAIRO ROADS.

A.—Population ...	...	...	...	...	...	600,000
B.—Approximate number of houses, ...	...	...	...	...	...	65,000
A.—Annual construction charge per head population	...	...	...	...	...	$\frac{905,380}{10}$; 60,000=0.151
B.—Annual construction charge per house	...	...	...	...	...	$\frac{905,380}{10}$; 65,000= 1.393

— 243 —

ANNUAL MAINTENANCE CHARGE.

A.—Per head population	79,100 ; 600,000=0.132
B.—Per house	...	...	...	...	...	...	79,100 ; 65,000= 1.217
					Total per head	...	0.283
					Total per house, ..	...	2.610
							0.132
							1.217

N.B.—At the end of 10 years the charge will be reduced to:—

A.—Per head,	...	...	...	...	...	...	0.132
B.—Per house	...	...	...	...	...	...	1.217

In London and Paris these charges amount to approx. : 0.450 per head and per annum.

E.—

E.—

YEARS.	SUBDIVISION OF							PAVED ROADS						Total area of Roads in different systems of paving.	Total area of earth Roads.	Total area of Cairo Roads.
	LIME STONE ROADS					BASALT		ROADS		Roads in compressed & "Briquettes" Asphalt						
	Bad Roads old system.	New lime Stone Roads			Totals of Roads in bad macadam	Bad Roads old system recon- structed in basalt.	Previous in earth recon- structed in basalt.	Newly made in basalt.	Total.	Previously in macadam and recon- structed in com- pressed asphalt.	Previously in earth and recon- structed in com- pressed asphalt.	In asphalt com- pressed briquettes	Total.			
		Previously earth	Newly made	Total.												
I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	
To end of December 1902 ..	858,950.27	86,657.35	73,553.22	160,210.57	1,019,160.84	371,692.73	—	—	374,692.73	—	—	6,482.00	6,482.00	1,400,335.57	1,423,187.65	2,823,523.22
In 1903 ..	778,145.28	2,577.25 to deduct from col. XV	6,939.94	9,517.19	—	81,597.92	147.1 to deduct from col. XV.	13,970.00	97,691.51	1,607.97	13,953.64 to deduct from col. XV.	—	13,161.61	37,568.32	16,678.38	—
Deduct Roads in briquettes recon- structed in basalt ..	—	—	—	—	—	—	—	—	—	—	—	2,400.00	—	—	—	—
Add newly made Roads (Col. III and VIII to total area of Cairo Roads ..	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	20,889.94
Total to end of December 1903 ..	778,145.00	89,234.00	80,493.00	169,727.00	917,873.00	456,289.00	117.00	13,950.00	470,387.00	1,607.00	13,953.00	4,082.00	19,643.00	1,437,903.00	1,406,509.00	2,844,413.00
Percentage ..	54.1	6.2	5.6	11.8	65.9	31.7	0.01	% 1.0	% 32.7	% 0.1	% 1.0	% 0.3	% 1.4	% 100	% 49.5	% 100
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

F.---REPAIRS BY HAND-LABOUR.

Year.	Area repaired	Material.			Labourers.		Sakkas and fantass water carriers.		Carts		Total sums.
		Stone.	Sand.	Water.	Days.	Sum.	Days.	Sum.	Days.	Sum.	
1903	218,052	7,917	2,131	2,494	12,545	643	2,887	156	3,427	121	2,338
		10,051									
1902	245,748	8,120	2,180	2,546	12,915	649	2,814	165	3,574	194	2,622
		10,300									

REPAIRS PER HAND-LABOUR.		1903.	1902.
1. Depth stone per square metre ... ..	...	7,917: 218,052 = 0.032	0.033
2. Proportion of sand per cubic metre of stone ... ..	...	2,131: 7,917 = 0.270	0.268
3. Cube of water used per cubic metre of stone ... ..	...	2,494: 7,917 = 0.315	0.314
4. Cube of water used per square metre repaired ... ..	...	2,494: 218,052 = 0.010	0.010
5. Mean surface required per day of workman ... ..	...	248,052: 12,545 = 19.77	19. 03
6. Mean surface watered per day of fantass... ..	...	248,052: 2,887 = 85.92	87. 33
7. Mean cubic transported per day of cart ... ..	...	10,051: 3,427 = 3.214	2.882
8. Load of cart per journey ... ..	...	24: 6,828 = 3.515	4.164
9. Cost price of materials per square metre required... ..	...	1,418: 218,052 = 0.0065	0.0054
10. " per labourer... ..	...	643: 218,052 = 0.0026	0.0026
11. " per sakkas and fantass ... ..	...	156: 218,052 = 0.0006	0.0007
12. " per cart... ..	...	121: 218,052 = 0.0017	0.0020
13. Total cost price ... ..	...	2,338: 218,052 = 0.0094	0.0107

G.—PERCENTAGE TABLE.

YEAR.	Material, stone, sand, water c.	LABOUR.				Cost price per m ² .
		Men c.	Sukkas & Fantass c.	Carts c.	Total c.	
1903 ...	178	275	67	180	522	L.L. M.
1902 ...	501	218	63	188	199	0.0091 0.0107

H.—STEAM ROLLER REPAIRS.

YEAR.	Repaired area.	Material		Labour		Fantass.		Carts.		Steam Roller.		Total amount L. E.
		Stone	Sand, Water	Days.	Sum L. E.	Days.	Sum L. E.	Days.	Sum. L. E.	Days.	Sum. L. E.	
1903 ...	26,170	3,022 <u>3,408</u>	886	2,765	162	138	19	4,005	181	70	91	969
1902 ...	31,180	2,838 <u>3,103</u>	981	3,130	179	115	17	572	74	89	106	871

		1903		1902	
1.	Depth stone per square metre	3,022	26,170 =	0.115	0.091
2.	Proportion of sand per cubic metre of stone ...	386	3,022 =	0.128	0.199
3.	Cube of water used per cubic metre of stone ...	886	3,022 =	0.293	0.317
4.	Cube of water used per square metre repaired ...	886	26,170 =	0.031	0.032
5.	Mean surface repaired per day of Fantass ...	26,170	2,765 =	9.46	9.96
6.	Mean surface watered per day of Fantass ...	26,170	138 =	189.63	271.13
7.	Mean cubic transported per day of cart. ...	3,108	1,005 =	3.391	5.949
8.	Load of cart per journey.	21	6,782 =	3.539	2.017
9.	Mean surface rolled per day of steam roller ...	26,170	70 =	373.86	350.31
10.	Total mean cost price of rolling	94	26,170 =	0.0036	0.0031
11.	Total mean cost price per square metre of repairs.	969	26,170 =	0.037	0.028

J.—BASALT REPAIRS.

Year.	Area repaired.	Material				Men		Fantass		Carts		Steam roller.		Kilometre tons		Total Amount.																																																																																																																																																																																																												
		Stone.	Binding.	Water.	Sum.	Days.	Sum.	Days.	Sum.	Days.	Sum.	per M ² of roads.	per Ma of material.																																																																																																																																																																																																															
														C.M.	C.M.		L. E.	L. E.	L. E.	L. E.																																																																																																																																																																																																								
1903	171,803	14,517	1,735	6,691	2,344	21,555	1,292	880	123	5,173	769	565	692	0.886	9.882	5,220																																																																																																																																																																																																												
1902	120,442	9,836	1,295	4,856	1,852	16,052	963	609	91	3,219	419	373	558	0.912	10.708	3,883																																																																																																																																																																																																												
<table><tr><th colspan="10"></th><th colspan="7">1903.</th></tr><tr><td colspan="10">1. Depth stone, per M²</td><td>14,517; 171,803=</td><td>1.735; 11,517=</td><td>6,691; 14,517=</td><td>6,691; 171,803=</td><td>7.97</td><td>197.76</td><td>1902.</td></tr><tr><td colspan="10">2. Proportion of material of aggregation per M³ of stone</td><td>1.735; 11,517=</td><td>1.735; 11,517=</td><td>6,691; 14,517=</td><td>6,691; 171,803=</td><td>7.97</td><td>197.76</td><td>0.082</td></tr><tr><td colspan="10">3. Cube of water used per M³ of stone</td><td>6,691; 14,517=</td><td>6,691; 14,517=</td><td>6,691; 14,517=</td><td>6,691; 171,803=</td><td>7.97</td><td>197.76</td><td>0.119</td></tr><tr><td colspan="10">4. Cube of water used per M² repaired</td><td>6,691; 171,803=</td><td>6,691; 171,803=</td><td>6,691; 171,803=</td><td>6,691; 171,803=</td><td>7.97</td><td>197.76</td><td>0.494</td></tr><tr><td colspan="10">5. Mean surface repaired per day of workman...</td><td>171,803; 21,555=</td><td>171,803; 21,555=</td><td>171,803; 21,555=</td><td>171,803; 21,555=</td><td>7.97</td><td>197.76</td><td>0.010</td></tr><tr><td colspan="10">6. Mean surface watered per day of fantass ...</td><td>171,803; 880=</td><td>171,803; 880=</td><td>171,803; 880=</td><td>171,803; 880=</td><td>7.97</td><td>197.76</td><td>7.50</td></tr><tr><td colspan="10">7. Mean cube transported per day of cart...</td><td>16,252; 5,173=</td><td>16,252; 5,173=</td><td>16,252; 5,173=</td><td>16,252; 5,173=</td><td>7.97</td><td>197.76</td><td>197.76</td></tr><tr><td colspan="10">8. Load of cart per journey</td><td>21; 6,282=</td><td>21; 6,282=</td><td>21; 6,282=</td><td>21; 6,282=</td><td>7.97</td><td>197.76</td><td>3.157</td></tr><tr><td colspan="10">9. Mean surface rolled per day of steam roller ...</td><td>171,803; 565=</td><td>171,803; 565=</td><td>171,803; 565=</td><td>171,803; 565=</td><td>7.97</td><td>197.76</td><td>3.471</td></tr><tr><td colspan="10">10. Mean cost price of rolling</td><td>692; 171,803=</td><td>692; 171,803=</td><td>692; 171,803=</td><td>692; 171,803=</td><td>7.97</td><td>197.76</td><td>322.90</td></tr><tr><td colspan="10">11. Total mean cost price per M² repaired</td><td>5,220; 171,803=</td><td>5,220; 171,803=</td><td>5,220; 171,803=</td><td>5,220; 171,803=</td><td>7.97</td><td>197.76</td><td>0.0010</td></tr></table>																											1903.							1. Depth stone, per M ²										14,517; 171,803=	1.735; 11,517=	6,691; 14,517=	6,691; 171,803=	7.97	197.76	1902.	2. Proportion of material of aggregation per M ³ of stone										1.735; 11,517=	1.735; 11,517=	6,691; 14,517=	6,691; 171,803=	7.97	197.76	0.082	3. Cube of water used per M ³ of stone										6,691; 14,517=	6,691; 14,517=	6,691; 14,517=	6,691; 171,803=	7.97	197.76	0.119	4. Cube of water used per M ² repaired										6,691; 171,803=	6,691; 171,803=	6,691; 171,803=	6,691; 171,803=	7.97	197.76	0.494	5. Mean surface repaired per day of workman...										171,803; 21,555=	171,803; 21,555=	171,803; 21,555=	171,803; 21,555=	7.97	197.76	0.010	6. Mean surface watered per day of fantass ...										171,803; 880=	171,803; 880=	171,803; 880=	171,803; 880=	7.97	197.76	7.50	7. Mean cube transported per day of cart...										16,252; 5,173=	16,252; 5,173=	16,252; 5,173=	16,252; 5,173=	7.97	197.76	197.76	8. Load of cart per journey										21; 6,282=	21; 6,282=	21; 6,282=	21; 6,282=	7.97	197.76	3.157	9. Mean surface rolled per day of steam roller ...										171,803; 565=	171,803; 565=	171,803; 565=	171,803; 565=	7.97	197.76	3.471	10. Mean cost price of rolling										692; 171,803=	692; 171,803=	692; 171,803=	692; 171,803=	7.97	197.76	322.90	11. Total mean cost price per M ² repaired										5,220; 171,803=	5,220; 171,803=	5,220; 171,803=	5,220; 171,803=	7.97	197.76	0.0010
										1903.																																																																																																																																																																																																																		
1. Depth stone, per M ²										14,517; 171,803=	1.735; 11,517=	6,691; 14,517=	6,691; 171,803=	7.97	197.76	1902.																																																																																																																																																																																																												
2. Proportion of material of aggregation per M ³ of stone										1.735; 11,517=	1.735; 11,517=	6,691; 14,517=	6,691; 171,803=	7.97	197.76	0.082																																																																																																																																																																																																												
3. Cube of water used per M ³ of stone										6,691; 14,517=	6,691; 14,517=	6,691; 14,517=	6,691; 171,803=	7.97	197.76	0.119																																																																																																																																																																																																												
4. Cube of water used per M ² repaired										6,691; 171,803=	6,691; 171,803=	6,691; 171,803=	6,691; 171,803=	7.97	197.76	0.494																																																																																																																																																																																																												
5. Mean surface repaired per day of workman...										171,803; 21,555=	171,803; 21,555=	171,803; 21,555=	171,803; 21,555=	7.97	197.76	0.010																																																																																																																																																																																																												
6. Mean surface watered per day of fantass ...										171,803; 880=	171,803; 880=	171,803; 880=	171,803; 880=	7.97	197.76	7.50																																																																																																																																																																																																												
7. Mean cube transported per day of cart...										16,252; 5,173=	16,252; 5,173=	16,252; 5,173=	16,252; 5,173=	7.97	197.76	197.76																																																																																																																																																																																																												
8. Load of cart per journey										21; 6,282=	21; 6,282=	21; 6,282=	21; 6,282=	7.97	197.76	3.157																																																																																																																																																																																																												
9. Mean surface rolled per day of steam roller ...										171,803; 565=	171,803; 565=	171,803; 565=	171,803; 565=	7.97	197.76	3.471																																																																																																																																																																																																												
10. Mean cost price of rolling										692; 171,803=	692; 171,803=	692; 171,803=	692; 171,803=	7.97	197.76	322.90																																																																																																																																																																																																												
11. Total mean cost price per M ² repaired										5,220; 171,803=	5,220; 171,803=	5,220; 171,803=	5,220; 171,803=	7.97	197.76	0.0010																																																																																																																																																																																																												

K.—PERCENTAGE TABLE.

YEAR.	Material, stone, water, binding %	LABOUR.				Steam roller %	Cost price per M ²
		Men, %	Fantass %	Carts %	Total %		
1903	11.9	21.7	2.1	11.7	11.8	13.3	0.0304
1902	17.7	21.8	2.3	10.8	37.9	11.1	0.032

Q.—REPAIRS OF KERBS.

YEAR.	Kerbs.			Materials.					Daily labour.				Cuts.		Total.		
	Total length.	Total length.	sum	Lime.	Sand	Plaster and Cement.	Water	sum.	Mason	Stone-cutters.	Labourers	sum	Days	sum			
	Old.	New															
1903	...	7,592	976	174	—	34	1	5	2	267	207	633	98	87	13	287	
		8,568															
1902	...	12,175	1,627	239	2	32	1	8	6	327	319	755	119	7	1	365	
		13,762															
										1903			1902				
a.	Cost price of materials per lineal metre									176:	8,568=0.0206			0.0178			
b.	..	of labour									98:	8,568=0.0114			0.0086		
c.	..	of carts									13:	8,568=0.0015			0.0001		
d.	Total cost price									287:	8,568=0.0335			0.0265			

S.—QUARRIES.

MATERIAL.	Touah and Old Cairo.	Abbassieh	Abou Zaabal.	Total.	Sand, Abbassieh.
	M ³	M ³	M ³	M ³	M ³
1903. Road metal and sand ...	3,197	8,624	21,827	33,648	12,220
1902.	2,695	7,542	16,278	26,515	8,010

NEW BRIDGES ACROSS THE NILE

By your orders a very rough estimate of a bridge across the Nile had been prepared by M. Reboul in 1902.

During your absence in the Sudan Sir Eldon Gorst requested me to complete this project.

The river section chosen was approved by the Inspector General of Irrigation as fulfilling the conditions of a permanent and settled direction of flow.

A sketch showing the position of the main and subsidiary bridges is attached.

The work of triangulation and survey necessary for measuring the areas to be expropriated was begun in April and May. Soundings of the main river and Roda branch were taken at the same time.

The specification was based on that in use at the Railway Department, but considerable modifications were introduced. We are indebted to M. Husson, of the Railway Department, and M. Holt, Vice Principal of the Polytechnic School, for advice and assistance. The entire specification was translated into English introducing English standard weights measures. The French original was finally submitted to Mr. de Rocca Serra, and the English to M. Brunyate. The complete classification of clauses is due to M. Brunyate. Mr. Clifton concluded all preliminaries after my departure for Europe.

The whole of the documents were approved by you on the 7th July and tenders invited in the Official Journal on the 21st of the same month. Copies of the specification were sent to France, England, United States of America, Austria, Belgium, Switzerland, Italy and Germany.

February 1st, 1904 was fixed as the latest date for sending in offers.

A preliminary project showing proposed type of bridge was prepared by M. Zarzecki, of Mr. Reboul's Office. This project was brought to a stage of completion which enabled a close estimate of the probable cost of the bridge to be prepared.

Owing to the skill and energy of Mr. Reboul and the assistance of Abdel Halim Pasha, Director General of Wakfs, the usually interminable negotiations for transfer of the land required for roads were brought to a successful termination in about six months.

The mean price paid per acre was L.E. 300.

The following data were taken as a basis for the preparation of the project:

Waterway Main Nile R.L. 21.13=	...	...	...	...	M ²	5725
.. Roda branch =	...	...	...	...	..	533
Total...						M ² 6258
Maximum flood discharge per section	...	...	...	...	M ²	12000

Smaller bridges.		Main New bridge	Kasr-el-Nil
	R.L. Road way	22.50	23.80
	Bottom boom	22.20	22.20
	Clear H. bottom boom above H.F.L.	1.07	1.07
83 Old Cairo ... }	Length bridge M.	535	406
67 Kasr-el-Aini ... }	Opening span	two of 20.0	one of 23.73
	R.L. bed now	+5	+1

The original estimate was as follows:—

Main bridge steel.

Length.	Width.	Area	Weight Sq. M. Kg.	Tons.
(535 ×	20)=	10700 ×	340=	3638

Steel 3638 Tons × L.E. 17.5=	...	...	...	...	L.E.	63,665
Piers and abutments	...	...	...	...	..	60,000

Small bridges steel.

Length.	Width.	Area.	Kg.
(83+67) ×	15	2250 ×	340

Tons 765 × L.E. 17.5=	...	...	...	...	L.E.	13,388
Piers and abutments	...	...	...	...	..	12,000
						L.E. 149,053

Main bridge road way and foot paths.

M ² 10700 × L.E. 1.5	L.E.	16,050
---------------------------------	-----	-----	-----	-----	------	--------

Small bridges as above.

M ² 2250 × L.E. 1.5	...	...	...	...	L.E.	3,375
						L.E. 168,478

Filling for roads from L.L. 18 to 21.50=	...	...	...	..	11,200
Expropriation	...	...	...	..	17,000
Macadam and kerb	...	...	...	..	7,892
Retaining walls	...	...	...	..	558
Staff	...	...	...	..	4,600
Unforeseen	...	...	...	..	20,272

230,000

The revised estimate reduces the amount for expropriation by L.E.8,812. The value of the bridge proper was increased by a similar amount, that is to L.E.177,290.

The R.L. of the lower boom of the main bridge girders is fixed at 2250 or M. 1.07 above R.L. 21.13 which is assumed as the H.F.L. at Roda.

The crest of the avenues of Roda island which will be about $2\frac{1}{2}$ kilom. in length is fixed at 21.50, an average height of 3.50 above the present level.

It is proposed to give these avenues a width of 25 metres.

The work of the following engineers attached to Mr. Reboul's Office merits special mention :

Mr. Zarzecki.
.. Schoechlin.
.. Ricordi
.. Ahmet Omar.

CART SERVICE

ESTABLISHMENT.

The Cart Service commenced the year with an establishment of 118 animals and finished with 119—an increase of 1 mule.

11 mules were purchased through the Veterinary Department to replace the wastage which was as follows :—

Died : " Natural causes "	3
Destroyed : " Infectious diseases "	2
.. " " Old age " and " chronic lameness "	6
Total	<u>11</u>

HEALTH.

The daily percentage of animals sick and under treatment was 2.8 of which 1.3 was due to accidents during work. These figures are even more satisfactory than those of 1902.

TRANSPORT.

The installation of a Decauville line at the Abbassieh quarries has greatly facilitated transport and prevented the overdriving of mules.

The great distance of the stone and sand quarries from the city and consequent higher rate of transport is a considerable factor in increasing the cost of the making and upkeep of the roads.

After another year's experience of the relative merits of the large double-wagon and small single cart for transporting stone and sand in Cairo, the conclusion we have arrived at gives the preference to the small carts.

COST.

The average daily cost of P.T. 14 per animal, including cart, driver stabling repairs, etc., etc., has been maintained against the outside charges of 23 to 25 P.T.

SHOEING.

The system introduced from the commencement of 1903 of the Service shoeing its own animals has given unqualified satisfaction.

The monthly cost of shoeing, including wages, material, depreciation of tools, etc. worked out at P.T. 5 per animal, or 120% cheaper than in 1902, when we paid the Veterinary Department 11 P.T. per animal.

The Service has gained most from the fact that the shoeing is now done after the day's work, thus permitting the animals to go straight to work in the mornings: whereas formerly, the best part of the working day was lost owing to the animals being shod in the mornings. Each animal has its special day in the month for shoeing and on that day whether the old shoes are good or not the animal's feet are trimmed and new shoes are fitted.

As a result there is not a mule in the Service with an unsound foot.

REPAIRS.

After exercising the strictest economy it has been found that for the maintenance of carts and harness in a condition creditable to a Government Service the yearly repairs in perpetuity would cost as follows:—

Carts	L.E. 4,430	Milliemes	or 30 to 40%	of cost price
Harness	.. 1,500	..	or 25 to 30% „

The wear and tear on a stone cart is of course heavier than that on any other.

RECEIPTS.

The receipts for work done, stores supplied, animals hired, etc., to outside Services amounted to L.E. 1,178.

ESTABLISHMENT.

As stated in 1902, the number of animals now in the Service is not sufficient to transport all the material necessary for road-making and repairs and, in consequence, a portion of the transport is done by outside contractors at a price from 30 to 40% higher than it could be done by the Service Carts.

At least 20 more animals are necessary. The initial cost would be about (25 - 20) = L.E. 500, and the yearly cost of maintenance would be L.E. 1,000.

STABLING.

There is only proper stabling accommodation for 60, or half of the available animals. We are obliged to keep the remaining animals in the open without shelter. The animals are also too closely packed and there are frequent accidents to syces in consequence. Stables are being built out of current funds, that is by degrees.

STAFF.

Mr. Potheary, the Stablemaster, merits high commendation for the excellent way in which he carries out his duties.

COMPARISON OF COST OF FORAGE : 5 YEARS.

FORAGE.	Per ton. 1899-1900		Per ton. 1900-1901		Per ton. 1901-1902		Per ton. 1902-1903		Per ton. 1903-1904	
	L.E.	M.	L.E.	M.	L.E.	M.	L.E.	M.	L.E.	M.
Beans	5	402	6	360	6	087	6	717	6	855
Barley	5	079	5	850	5	390	5	807	5	928
Tibbin	1	642	2	370	1	896	1	963	2	320
Bran	3	898	4	000	4	320	4	783	4	676

% OF YEARLY INCREASE ON COMPARISON WITH 1899-1900.

FORAGE.	Per ton. 1899-1900		Per ton. 1900-1901		Per ton. 1901-1902		Per ton. 1902-1903		Per ton. 1903-1904	
	A		Increase on A		Increase on A		Increase on A		Increase on A	
	L.E.	M.	%		%		%		%	
Beans	5	402	17.7		12.6		24.3		26.8	
Barley	5	069	15.4		6.3		14.5		16.9	
Tibbin	1	642	44.2		15.4		19.5		41.2	
Bran	3	898	2.6		10.8		22.7		20.0	

PUBLIC LIGHTING, 1903.

BUDGET.

No addition was made to the Budget for public lighting during 1903 and consequently there has been no increase in the number of lamps.

REQUIREMENTS.

As stated in last year's report 6,500 more lamps are urgently required. The approximate annual cost at existing rate would be L.E. 43,500.

INCANDESCENT LIGHTING.

As forecast in 1902 the Gas Company have consented to introduce incandescent burners at their own expense for public lighting to replace the old flat-flame burners. As with this burner an intensity equivalent to or higher than the contract minimum can be produced by the consumption of 80 litres of gas the Company can set an economy of $(140-80)=60$ litres per lamp against the higher cost represented by wear and tear of mantles. The Company probably gain about L.E. 3,000 per annum by this change.

The work of changing the burners commenced in October, and at the end of the year about 500 lamps were incandescent.

There can be no question as to the result: it is very satisfactory and is a great advance on the old system.

FINES.

The fines levied on the Gas Company during 1903 for lamps giving defective light show a decrease of about 50% on 1902. This is due in part to the greater attention given to repairs, &c., but mainly to the improvement in the quality of gas supplied since the introduction of a testing laboratory under the very able guidance of Mr. Lucas. Heavy fines (L.E. 441) were inflicted on the Company for bad quality gas.

A comparison of the number of lamps reported as defective is interesting in 1902 and 1903.

	Lamps extinguished.	Lamps giving less than standard flame.
1902	586	43,800
1903	512	10,417
Decrease ...	74 or 12.5%	33,383 or 76%

The rules at present in force are as follows :—

1. For a lamp found extinguished a fine is at once inflicted.
2. For a lamp giving less than the standard flame it is reported to the Company and if on the following night it is still defective a fine is inflicted for both nights.

LUNAR PERIOD.

Under article 16 of the contract one fifth of the total lamps are unlit during the lunar period, or 10 nights in each month. Of course the Company receive no payment for these lamps.

Various complaints have been received with regard to this regulation, and public lighting would be distinctly improved if, during at least 5 months (October to February), the above quoted article could be suspended. This measure would entail an extra expenditure of L.E.135 monthly, or for the 5 months L.E. 675. As the Service has no reserve fund a special grant would be required from the Finance.

The average rate of additional lamps installed would also be augmented from L.E. 6.701 Milliemes per annum to L.E. 6.925 Milliemes per annum each.

STAFF.

Mr. Mégalogéni has carried out his duties in a very efficient manner.

GAS TESTING

and introduction of electric public lighting.

FINES

The increase of fines consequent on the introduction of scientific testing initiated by Mr. Lucas evidently created suspicion in the minds of the Cairo representatives of the Gas Company. They impugned the accuracy of Mr. Lucas' tests and asked permission to bring from Paris a gas expert to check our apparatus and methods. This permission was at once granted. In due course M. Couderchon, an expert of repute, arrived. His report and Mr. Lucas' reply are attached. It is evident from a perusal of the two that the accuracy of Mr. Lucas' methods is fully established.

The vexed question of the interpretation of certain clauses in the gas contract has again been raised. Startling anomalies at present obtain in Cairo.

We may accept as an axiom that gas is cheaper than electricity.

In Cairo a gas lamp of 12 c.p. costs per annum L.E.6.701.

In Helwan and other towns of Egypt an electric lamp of 20 c.p. costs from L.E.2.25 to L.E.3 per annum.

In contradistinction to accepted practice electricity in Cairo would, therefore, appear to be much cheaper than gas.

We have asked the Company, either to reduce the price of gas to say 260 P.T. per lamp, or to introduce public electric lighting at a rate similar to that charged by Concessionnaires in Egypt.

They have refused both requests.

A scheme carefully worked out by Mr. Jacot, Government electrician, proves that by erecting and working its own station Government could furnish electric lighting at L.E.2.60 per lamp of 32 c.p. on the 6,000 lamps required; this equals a saving of L.E.4.101 per lamp and per annum compared to the present price.

REPORT ON THE GAS TESTING LABORATORY FOR 1903.

At the end of January last a complete equipment of modern French gas testing apparatus, such as is used at the present time in the Paris gas testing stations, was received and at the beginning of April an efficient control of the Cairo gas supply for purity, pressure and illuminating power was begun.

PURITY.

The only standard for purity recognized in France and demanded by the Cairo contract is that the gas shall be entirely free from sulphuretted hydrogen.

This impurity has, however, been found present on three occasions and each time the Company have been fined 50 francs.

PRESSURE.

The contract requirements for pressure, namely that it shall not fall below 15 millimetres during the hours of public lighting, are very inadequate, especially in view of the increased use of gas for heating purposes. Except on several occasions when the pressure has momentarily fallen to zero, doubtless due to shutting off the gas in connection with repairs to the mains, the pressure has always been above that demanded.

The mean pressure between sunrise and sunset is about 30 millimetres, and between sunset and sunrise about 25 millimetres, while the lowest pressure recorded (excepting on the several occasions mentioned) was 18.5 millimetres.

ILLUMINATING POWER.

When first tested the illuminating power was found to be considerably below the contract requirements, on one occasion falling as much as 34% below the standard, while the mean for the first month was 19.5% too low. Gradually, however, the illuminating power has improved, and since August it has invariably been better than the contract demands.

Since the Government are not required to pay for an illuminating power not supplied, varying sums amounting in all to L.E.435,638 Millions were deducted from the Company's invoices whenever the mean illuminating power for the month was deficient, the invoices being made out on the assumption that the illuminating power is always according to the contract.

The following table summarizes the various results obtained:—

MONTHS.	PURITY. No. of times impure	Fines for impurity.		PRESSURE Minimum.	ILLUMINATING POWER Deviation from contract	Fines for deficient illuminating Power.	
		L. E.	M.			L. E.	M.
April... ..	—	—	—	220	19.5% below.	No deduction made.	
May	—	—	—	18.5	6.9% ..	111	530
June	—	—	—	230	6.1% ..	92	604
July	—	—	—	21.5	10.3% ..	158	189
August. ...	—	—	—	190	4.2% ..	73	315
September ...	—	—	—	210	0.3% above.	—	
October ...	1	1	928	210	3.4% ..	—	
November ...	1	1	928	190	4.1% ..	—	
December ...	1	1	928	200	3.0% ..	—	
Total ...	3	5	784	—	—	435	638

It will be seen, therefore, that the direct result of the regular and systematic testing of the gas supply has been an increase of over 20% in the illuminating power and an infliction of penalties amounting in all to over L.E. 441.

RAPPORT DE M. COUDERCHON
sur
L'INSTALLATION DU BUREAU D'ESSAIS PHOTOMÉTRIQUES
AU MINISTÈRE DES TRAVAUX PUBLICS, AU CAIRE.

L'appareil photométrique installé dans un local dépendant du Ministère des Travaux publics, est identique à ceux en usage dans les bureaux d'essais de la ville de Paris.

La balance a été construite par Delenil ; le bec Bengel, monté sur chandelier, est alimenté par un tube rigide métallique reliant la sortie du compteur au chandelier. La balance et le chandelier sont supportés par un bâti en fonte.

(1) L'extrémité du tube conique de la lunette a deux centimètres de diamètre.

Le local est spacieux et très bien ventilé : une hotte en tôle avec tuyau de dégagement sur l'extérieur est placée au-dessus des brûlures, dans les conditions réglementaires.

(2) *Défectuosités constatées dans les appareils.* — Le plateau de l'étrier de la balance, sur lequel repose la lampe pendant les essais, est de 6 millimètres plus grand dans le sens de son diamètre que le bord extérieur du fond de la lampe, de sorte que la lampe joue dans l'étrier ; si donc cette lampe n'est pas parfaitement centrée sur l'étrier, elle perd sa verticalité et incline soit en avant soit en arrière du plan parallèle au disque photométrique passant par le centre du bec Bengel.

La flamme de la lampe Carcel peut dévier ainsi de 2 centimètres environ soit en avant soit en arrière et sa distance au photomètre se trouve être de 0^m98 à 1^m02.

Le bec Bengel étant à 1^m00, l'erreur commise de ce fait peut aller jusqu'à 4 ‰.

À plusieurs reprises, dans nos visites à la chambre noire du département, nous avons constaté cette position anormale de la lampe et nous en avons fait l'observation à M. Lucas, chef du Laboratoire et à M. Samman, son aide.

(3) *Bec Bengel.* — L'instruction pratique de Dumas et Regnault, décrivant la nature et les dimensions des appareils photométriques, fixe

à $\frac{1}{16}$ de millimètre le diamètre moyen des trous du bec Bengel. Or, nous avons constaté au moyen de notre aiguille-jauge, que les trous du bec Bengel en service à la chambre noire du Ministère des Travaux publics, n'avaient que $\frac{1}{16}$ de millimètre de diamètre, en moyenne.

D'autre part, le diamètre du courant d'air intérieur du bec Bengel doit être de 9 millimètres ; or, dans le bec Bengel que nous avons vérifié, ce diamètre est de 9 millimètres dans la hauteur du tube en porcelaine, mais il n'est que de 6 à 7 millimètres dans la hauteur de la partie métallique. L'air d'alimentation intérieure de la flamme n'est donc pas suffisant.

Ces deux défauts contribuent à rendre la flamme moins éclairante, le gaz brûlant dans de mauvaises conditions.

Nous estimons à 2^{me} l'erreur commise de ce fait au détriment du pouvoir éclairant.

(4) *Compteur d'abonné.* — Le gaz, avant d'arriver aux appareils photométriques, passe par un compteur ordinaire d'abonné de dix becs de capacité. Il y a lieu de supprimer ce compteur qui n'est d'aucune utilité, la Compagnie devant fournir gratuitement au Gouvernement le gaz consommé par le laboratoire photométrique.

La benzine est très soluble dans l'eau ; une partie de celle contenue dans le gaz destiné aux essais peut donc se dissoudre dans l'eau du compteur et cela au préjudice du pouvoir éclairant du gaz. Le gaz doit venir directement de la conduite de la rue au compteur photométrique, sans passer par un compteur intermédiaire.

(5) *Vérification de l'étanchéité des appareils.* — La vérification de l'étanchéité des appareils, lors de la vérification du compteur se fait jusqu'au robinet du chandelier du bec Bengel ; nous croyons devoir faire remarquer que la recherche des fuites doit se porter jusqu'au bec Bengel même, car il peut exister une fuite, soit au raccord du manomètre, soit au raccord du bec Bengel ; le bec Bengel lui-même peut fuir s'il se produit une fissure dans le tube en porcelaine, comme cela arrive quelquefois.

Nous avons indiqué à M. Lucas, le moyen de faire cette recherche de fuite, en obturant les trous du bec Bengel avec la paume de la main et en ouvrant le robinet du chandelier pour établir la pression jusqu'au bec.

(6) *Nombre d'essais à effectuer dans la soirée.* — Dans la méthode employée à Paris pour la vérification du pouvoir éclairant du gaz, il est spécifié que les essais seront effectués de huit heures à onze heures du

soir, c'est-à-dire au moment du plein éclairage, que les expérimentateurs feront trois essais à une demi-heure d'intervalle, et que le titre du gaz sera établi en prenant la moyenne des trois essais.

(7) Or, nous avons remarqué, en examinant les rapports journaliers des essais, que lorsque dans un essai la consommation de l'huile est en dehors des limites de 38 à 46 grammes à l'heure, cet essai est annulé, et qu'ainsi la moyenne est calculée sur deux essais seulement : il pourrait même n'y avoir qu'un seul essai valable si la consommation de l'huile était normale dans deux essais. Nous croyons qu'il y a dans cette manière de procéder, une erreur d'interprétation de l'instruction de Dumas et Regnault, et nous estimons que la moyenne des essais d'une soirée ne peut être établie que sur trois essais. Il suffit pour cela, lorsqu'un essai doit être annulé pour consommation anormale d'huile, de le recommencer en modifiant le régime de la lampe.

(8) *Température du laboratoire.* — Les rapports journaliers des essais indiquent que la température dans le local où sont effectués les essais atteint généralement 20 à 23°, et jusqu'à 30°, dans les nuits d'été : l'eau du compteur et le gaz qui y passe prennent donc cette température, cela ne présente aucun doute surtout dans les cas particuliers du laboratoire du Gouvernement, où le gaz passe non seulement dans le compteur d'expérience, mais encore dans un compteur ordinaire d'abonné, situé dans le laboratoire même, comme nous l'avons fait remarquer plus haut.

On peut admettre que la température du gaz dans les conduites, (qui sont posées à un mètre de profondeur dans le sol) est de 15° ; c'est avec du gaz à cette température de 15° que les essais devraient être effectués.

Le gaz passant de la température de 15° à celle de 20°, 25° ou 30°, se dilate plus ou moins et l'accroissement de volume lui fait perdre nécessairement de son pouvoir éclairant.

Le coefficient de dilatation des gaz est de $\frac{1}{273}$ de leur volume pour 1 degré, ou 0,003665.

Si nous appliquons la formule,

$$V_o = V \times \frac{1 + \alpha t_o}{1 + \alpha t}$$

V étant le volume du gaz consommé pendant l'essai à la température t (température de la chambre).

V_o étant le volume du gaz à la température t_o (température du gaz dans les conduites)

α étant le coefficient de dilatation pour l'°, nous aurons pour le cas d'une température de 30°

$$V_o = V \times \frac{1 + 0,000,366,5 \times 15^\circ}{1 + 0,000,366,5 \times 30^\circ}$$

$$V_o = V \times \frac{1,054275}{1,109950} = V \times 0,95$$

c'est donc par ce coefficient de 0,95 qu'il faudrait multiplier le chiffre de consommation de gaz donné par les essais, pour avoir le titre absolu du gaz : en ne tenant pas compte de cette correction, on fait une erreur au détriment de la Compagnie du gaz, de 5 % dans le cas particulier que nous avons pris et qui est, nous le reconnaissons, un maximum « en supposant que la température de la chambre ne dépasse jamais 30° ».

Les coefficients de correction aux diverses températures de 15° à 30°, seraient de :

pour 15°	...	...	...	...	...	...	...	...	...	1,000
16°	...	...	...	...	...	...	...	...	...	0,996
17°	...	...	...	...	...	...	...	...	...	0,993
18°	...	...	...	...	...	...	...	...	...	0,989
19°	...	...	...	...	...	...	...	...	...	0,986
20°	...	...	...	...	...	...	...	...	...	0,982
21°	...	...	...	...	...	...	...	...	...	0,979
22°	...	...	...	...	...	...	...	...	...	0,976
23°	...	...	...	...	...	...	...	...	...	0,972
24°	...	...	...	...	...	...	...	...	...	0,969
25°	...	...	...	...	...	...	...	...	...	0,966
27°	...	...	...	...	...	...	...	...	...	0,960
28°	...	...	...	...	...	...	...	...	...	0,956
29°	...	...	...	...	...	...	...	...	...	0,953
30°	...	...	...	...	...	...	...	...	...	0,950

La correction relative à la température ne se fait pas à Paris parce qu'on a admis que la température moyenne des chambres noires était à Paris, de 15°.

En été, en effet, la température des chambres noires ne dépasse pas 18°, et en hiver, il est facile de maintenir la température des chambres noires entre 12° et 16°, au moyen de la chaleur artificielle.

La correction est appliquée à Lyon, à St-Quentin et dans d'autres villes de France, mais notamment à Londres.

Il est de toute justice de l'appliquer au Caire, où la température extérieure est toujours au-dessus de la température moyenne du gaz dans les conduites.

(9) *Emplacement du bureau d'essais du Gouvernement.* — Le bureau d'essais du Gouvernement est situé à 3700 mètres de l'Usine, à l'une des extrémités de la ville du Caire, et dans un quartier où la consommation publique et privée est très faible.

Cette situation est des plus défavorables à la Compagnie du gaz, pour deux raisons principales :

1°. Il est admis par les techniciens, et par toutes les personnes qui s'occupent de gaz, Compagnies et Municipalités, que par un frottement continu dans le parcours des conduites, le gaz, si bien fabriqué qu'il soit, perd une partie de son pouvoir éclairant évalué à 1 % par kilomètre.

2°. Il est également reconnu par tout le monde, que le gaz qui s'immobilise, qui est stagnant dans les conduites, perd également de son pouvoir éclairant.

A l'appui de ces considérations, et pour en justifier le bien-fondé, nous rappellerons que, par application de l'article II, du traité du 7 février 1870, entre la ville de Paris et la Compagnie parisienne du gaz, les bureaux d'essais, à Paris, sont choisis par la ville, d'accord avec la Compagnie, vers les régions moyennes du réseau alimenté par chaque usine.

(10) En outre, et quoique les bureaux d'essais soient situés dans ces conditions, c'est-à-dire dans des emplacements où la consommation du gaz est considérable et où, par conséquent, le gaz ne séjourne pas dans les conduites, la ville autorise encore la Compagnie à purger la conduite secondaire et le branchement alimentant la chambre noire au moyen d'un bec intensif de 1.400 litres de débit à l'heure, raccordé sur le branchement de la chambre noire et que la Compagnie fait allumer à l'heure que bon lui semble et, au besoin, toute la journée.

En résumé, nous sommes d'avis qu'il serait de toute équité, que le Ministère des Travaux publics voulût bien tenir compte de toutes les considérations exposées dans la présente note, et reconnaître que la Compagnie du gaz du Caire, n'a qu'un but et qu'un désir, exécuter fidèlement les clauses du contrat, comme elle croit l'avoir fait jusqu'ici et remplir tous ses devoirs envers le Gouvernement et envers ses abonnés.

La Compagnie est donc en droit de demander de la modération et de la bienveillance à l'Administration Gouvernementale.

(11) Nous espérons que l'Administration voudra bien supprimer les amendes, ou plutôt les retenues, relatives au pouvoir éclairant du gaz, appliquées à la Compagnie pendant la période de l'été dernier qui court du mois de mai au mois d'août.

Avant de clore ce rapport, je tiens à dire que j'ai trouvé auprès des divers agents du Ministère des Travaux publics le plus aimable accueil et que, en particulier, M. Lucas, chef du Laboratoire, m'a reçu avec la plus grande courtoisie. Il n'a pas hésité à me faciliter toutes choses et à me laisser opérer en toute liberté. J'ai pu ainsi me convaincre qu'il apporte à ses travaux, en ce qui nous concerne, tout le soin et la minutie scientifique d'un homme de Laboratoire uniquement préoccupé de rechercher la vérité.

Le Caire, le 16 décembre 1903.

Signé : COUDERCHON.

*Ingénieur des ponts et chaussées,
Inspecteur de l'éclairage au gaz de la Ville de Paris.*

— — — — —

MR. LUCAS' NOTES
ON
MR. COUDERCHON'S REPORT.

N.B.—For purposes of reference the paragraphs in the original have been numbered and are referred to below under their respective numbers.

(1) The Government Photometer corresponds, and has always corresponded, exactly in this particular also to the instruments used in Paris.

The Gas Company's Photometer, as mentioned in my report for August last, had an aperture in the eye-piece that was much too small. This has been altered in accordance with Mr. Couderchon's instructions and is now correct.

(2) The instrument is as received from the makers.

The base of the lamp certainly fits too loosely into the scale pan of the balance, but the difference is 4 millimetres and not 6 millimetres as stated.

Care has always been taken in placing the lamp to avoid any inclination from the vertical position.

It is assumed by Mr. Couderchon that the error (if any) has always been against the Company. Since 60 different experiments are usually made each month this is barely possible unless done deliberately. It is likely that the lamp has occasionally deviated slightly from the perpendicular, but probably as often in favour of the Company as against, and in such cases it is usually found that the errors balance one another.

It is proposed to at once fix a metal ring to the base of the lamp so that the diameter shall correspond exactly with that of the balance and any possibility of error will thus be avoided for the future.

The Company's Photometer has the same defect.

(3) The Bessel burner deviates, as stated, from the standard laid down by Dumas and Regnault. It is, however, as received from the makers.

The defective burner has now been replaced by one kindly supplied by M. Couderchon, and examined by him in Paris and found to be correct.

(4) The Company and not Government fixed the meter in order that they might charge for the gas consumed, and the Government have paid about L.E.4 for the gas used since the testing commenced.

(5) The entire apparatus has been tested for leakage regularly once each week since it was erected.

The Company has on several occasions complained of the high pressure in the manometre affixed to the Bengel burner: had there been a leakage this pressure would have been below instead of above the normal.

(6) The Paris contract does not hold in Cairo, where no hours are specified. Further it has been found necessary in Paris to test the gas outside the contract hours, and since 1887, on the demand of the Municipal Council, such extra tests have been regularly made.

(7) During May, June, July and August various sums, amounting in all to L.E.435.638 mill., were deducted from the Company's invoices on account of the gas being below the contract requirement. Since August no such deductions have been made as the gas has been equal to the standard required.

During May and June there were no experiments "annulés".

During July one experiment was annulled, while during August there were five.

If the tests made on these evenings when one of the three experiments was annulled be entirely disallowed, instead of the results being in favour of the Company, as apparently is thought, it will be slightly against them.

Thus in July the gas was $10\cdot3\frac{6}{10}\%$ below the contract, while in August it was $4\cdot2\frac{2}{10}\%$ below. Disallowing all the tests on those nights when one experiment was annulled the mean for the month will be:—

July $10\cdot7\frac{7}{10}\%$ below contract.

August $5\cdot0\frac{0}{10}\%$ below contract.

and the Government could claim a still further (though very slight) deduction from the gas accounts for those months.

For the future an extra experiment will be made and the mean of three instead of two taken, should one be annulled.

(8) I am of opinion that the difference of temperature was taken into account once for all when the contract was drawn up.

In Cairo the burners must correspond with those in Paris, and the consumption of gas per burner must also correspond, but the amount of gas required to equal one Carcel is fixed at 110 litres instead of 105 litres as in Paris.

The mean Paris temperature at 9. p.m. (see attached note) is $10\cdot57^{\circ}\text{C}.$, while that of Cairo is $20\cdot33^{\circ}\text{C}.$ Now 105 litres at $10\cdot57^{\circ}\text{C}.$ will become 108·6 litres at $20\cdot33^{\circ}\text{C}.$, and under the contract the 105 litres of Paris gas are allowed to become 110 litres in Cairo.

In those French towns where a correction is made for temperature the standard is 105 litres as in Paris and not 110 as in Cairo.

No appeal to the English practice should be allowed, since the whole manner of testing in England is entirely different from that in France.

No reference to a temperature correction is made in the Cairo contract.

(9) The Company would seem to contend that the gas need fulfil the contract requirements only within a limited distance of the works and that elsewhere it might be of an inferior quality. This is untenable. (see pages 271 and 277).

(10) There seems no objection to the Company putting up such a burner as suggested, provided the consumption of gas be not charged to the Government.

(11) A return of the amount deducted from the Company's invoices for inferior quality of gas would seem to be a tacit admission that the Government tests were not reliable.

In addition I would point out that the meter through which the gas passes to the Photometer registers from 0·15 to 0·25 of a litre too little, or a mean of 0·20 litre.

In Paris any deviation of this kind from the 25 litres is allowed for in tests.

I have purposely refrained from making an allowance for this difference up to the present, although I propose doing so in the future, and thus there has always been an error of almost 1% (0·20 for 10 grams of oil = 0·84 for 42 grams of oil) in favour of the Company.

In conclusion I wish to express my entire confidence in the ability and impartiality of Mr. Couderchon, and in the careful and thorough manner in which all his work was conducted.

To prove that the difference in temperature between Cairo and Paris was taken into account in drawing up the contract.

MEAN TEMPERATURE AT 9 P.M.

MONTH.	PARIS (1) (1896)	CAIRO (2) (15 years 1884-1898)
January	3.70	12.10
February... ..	4.16	13.67
March	8.97	16.02
April	10.00	19.78
May..	14.07	23.22
June.	18.00	26.25
July.	19.68	28.06
August	16.41	26.99
September.	14.73	24.64
October	9.03	22.20
November.	3.58	17.25
December..	4.61	13.84
MEAN... ..	10.57	20.33

105 litres (Paris standard) at 10.57 C=101.1 litres at 0 C.
=108.6 " " at 20.33 C.

105 litres at Paris=108.6 litres at Cairo.

Paris standard 105 litres.

Cairo standard 110 litres.

(1) Annales du Bureau central Météorologique de France, Année 1896, Tome II, Observations.

(2) Report on the Meteorological Observations made at the Abbassia Observatory, Cairo 1900 p. 20.

EXTRACT FROM
“PUBLIC LIGHTING BY GAS AND ELECTRICITY”,

BY

W. J. DIBDIN, F.I.C., F.C.S.,

*Chemist and Superintending Gas Examiner to the Metropolitan Board of Works
and the London County Council (1882-1897).*

In the Gasworks Clauses Act it is stated that the Company shall provide a properly-fitted station for testing the illuminating power and purity of gas, but no specific position is assigned for the station, which is usually that arranged by the Company for its own purposes. In the Metropolis Gas Act of 1860, relating to the testing of the London gas, it was first provided that the site of the testing place should be within 1000 yards of the gasworks, but subsequently in 1876 this was altered so as to leave the Gas referees a free hand in fixing the position of the stations, in order that the gas might be tested in the district in which it was used rather than in the near proximity to the making places.

The necessity for more effective methods of testing the illuminating power of the gas supplied to the consumers has been frequently pointed out by the writer in the course of various official reports, in consequence of the discovery that the gas supplied in the district away from the official gas-testing station was very frequently 10"/₁₀₀ and even 20"/₁₀₀ below the standard. This fact was also pointed out at Liverpool by Mr. Bellamy, who adopted the system of testing the quality of the gas by the portable photometer, with the result that the supply, although in the hands of a company, was immediately equalised throughout the district, so that all consumers are now supplied with gas of equal value.

(Chapter I. page 86).

TRAMWAYS AND ELECTRIC LIGHTING

TRAMWAYS

CAIRO TRAMWAYS.

The working of the tramways has been very satisfactory, and no abnormal irregularity has occurred. The attached statistics show a considerable increase in traffic and receipts. Thus the number of passengers exceeds last year's figure by 13 $\frac{1}{2}$ and the number of car-kilometres has increased by 20 $\frac{1}{2}$. This is partly due to the opening of the Shubra line in May, 1903. This line connects the Bab-el-Hadid Square with the Nile bank at Rod-el-Farag, following the Shubra road for a length of nearly 5 kilometres. The track is chiefly double.

A great improvement has been introduced from a purely tramway point of view, by laying a line round the Mixed Tribunals. All cars going to Fagalla run now on this line, leaving the old track between Ataba-el-Khadra and the Crédit Lyonnais for the Boulae cars exclusively.

351 metres of double track has been substituted in the Place Mariette, near the new Egyptian Museum, for a similar length of single track.

STATISTICS.

	YEAR ENDING	
	June 30th, 1902.	June 30th, 1903.
Length of concession	50 years.	
Date of expiry	1946	
I.—TRAFFIC.		
Total number of passengers	16,926,050	19,225,331
Average daily number of passengers	46,373	52,672
Same in % of population	7.73	8.2
Train kilometres... ..	3,659,729	4,378,580
II.—LINE AND CARS.		
Length of single track lines (metres)	15,296	15,681
Length of double track lines	22,475	27,294
Total length of lines... ..	37,771	42,975
Number of motor cars	95	128
Number of trailers	59	79
III.—FINANCIAL.		
Share Capital Fcs.	6,000,000	
Gross revenue	2,256,671	2,530,212
Total working expenses	1,042,627	1,200,749
Percentage of working expenses to revenue	46.5	47.5
Interest on shares %	11.7	13.7
Directors' fees Fcs.	72,670	85,232
Carried to reserve fund (5% of net profit) ..	40,940	47,351
Distributed to shareholders	700,000	840,000
Gross revenue per car kilometre	0.56	0.58

ALEXANDRIA TRAMWAYS AND RAMLEH RAILWAY.

The Alexandria and Ramleh Railway Company have transformed their lines between Alexandria and San-Stefano to electrical traction. For this purpose the tramway generating station at Karmouz was increased by 2 new sets of 1000 HP. each, producing a three-phase current of 6500 Volts. This energy is transmitted to a sub-station situated at Bulkeley, first, by means of an underground high tension cable, running through the town of Alexandria, and secondly, by an overhead line, following the railway-track from the town-end to Bulkeley. The sub-station contains 3 sets of step-down and rotary transformers of 300 K.W. each, by means of which the three-phase high-tension current is converted into continuous current of 550 Volts, and distributed to the contact-lines. Transformers and Switchboard were furnished and erected by Messrs. Brown, Boveri & Co. and are of the latest type. The high tension overhead line was constructed by the Alexandria and Ramleh Railway Company itself, under the superintendence of this Service and every possible protective apparatus was installed with a view of preventing danger to life, in case of a wire breaking.

The electric traction was started at the beginning of January. The inspection and handing over of the installation took place on December 17th.

The accompanying tables show the extent of traffic on the two lines at the end of the year 1903:—

	A Alexandria Tramway.	B Ramleh Railway.
Length of single track m.	1,125	7,033
Length of double track... .. "	11,000	17,164
Total track "	12,125	24,197
Number of motor cars	55	22
Number of trailers... ..	45	31
Number of passengers conveyed... ..	9,293,272	3,062,749

CAIRO ELECTRICAL SUPPLY.

The number of private consumers, as well as the amount of current sold, has again considerably increased. This is shown on the attached tables.

6.4 kilometres length of new cable was laid under the public roadways as against 7.9 kilometres in the previous year.

For the purpose of purchasing a new generating plant of 400 HP. the Company requested permission to increase their share capital by 500,000 francs. This request, after examination by the Committee previously appointed, was granted.

Several applications for supplying current outside the limits of the concession having been made by the Company, Government, in individual cases, granted temporary authorization. The distribution of current in the suburbs of Cairo is now being studied by this Office.

ELECTRIC LIGHT, CAIRO.

				YEAR ENDING 30TH JUNE	
				1902.	1903.
GENERAL.					
Units sold	...	...	K.W. hours.	458,253	529,478
Increase on previous year...	...	...	%	24.8	15.3
Number of lamps connected	(10 c. p.).	...		54,152	64,160
Units sold per 10 c.p. lamp	...	...		8.38	8.25
Are-lamps connected..	...	...		79	97
Motors connected	...	...	H.P.	22	95
New cable laid during year	...	...	metres.	7871	6429
Number of consumers	...	...		1180	1409
FINANCIAL.					
Capital	...	...	Fcs.	2,500,000	3,000,000
Revenue (Units sold)..	...	...		458,144	529,349
Working Expenses	...	...		272,272	342,780
Cost per unit sold	...	...		0.594	0.646
Price per unit	...	...		1.00	1.00

NOTE.—These figures are presented by the Company.

Mansoura.

Street lighting has not been extended this year, but the number of private consumers shows an increase of 46% and has reached the figure of 140, representing a total of 5934 8 c.p. lamps connected.

The figures for 1902 were 96 subscribers and 4350 lamps.

Helouan.

The provisional handing over of this installation took place on November 25th, 1902. A temporary authorisation was granted to Messrs. Thos. Cook & Son, to work the plant, subject to the condition that certain modifications were to be introduced and certain defects to be remedied. A second was made on December 1st, 1903, after the Local Commission had stated, in writing, that the installation was complete.

This examination, however, proved that the concessionnaires had not succeeded in entirely overcoming all defects. As stated in our report of December 2nd, the voltage fluctuations were too considerable and caused unpleasant flickering. No provision had been made to prevent the smell of the petrol escaping. The bad smell and loud noise, caused by the explosions, led to general complaint, and a petition signed by 150 residents and tourists was presented to the Public Works Department.

The Supply Company were invited to at once remedy these defects and were further required to check the fluctuations by the end of the season. The final reception could in this manner be pronounced 6 months later. At the end of the first full working year, on December 31st, the extension of the installation is shown by the following figures :

Street lighting : 200 standards of 2 lamps each.							
private lamps connected (10 c.p.)=...	...	...	...	...	...	...	3894
Number of consumers= ...	...	...	...	...	...	...	71
Units sold <i>a)</i> to hotels= ...	...	...	...	...	...	...	15000
<i>b)</i> to private consumers=...	...	...	...	...	...	...	17400
Total ...							<u>32400</u> KWH

Price per unit 4 P.T.

Street lighting is paid for at the rate of L.E. 2.25 for each lamp of 26 candle power. As this sum has proved to scarcely cover the cost of production, Messrs. Thos. Cook & Son asked for permission to replace the 16-c.p. lamp by one of 10-c.p. and to increase the time of lighting in the same ratio. This would relieve their engines to a certain extent in the early part of the night, and allow for more private lamps to be connected. The High Commission was asked to approve of this alteration, as being generally advantageous, subject to the acceptance by the concessionnaires of a new lighting schedule, prepared by the Government Electrical Service and adjusted to the period of the rise and set of the moon.

Since February, these schedules have been in use, and it has been found possible to arrange the lighting in such manner, that the town

is never in complete darkness. This frequently occurred with the old contract time-table.

The total amount of energy spent in street lighting is the same as before.

Port Said.

The Government signed a contract for private lighting with Engène Lebon & Co. in July, and the plans were submitted and examined by this service in November. This distribution of 2×220 Volts continuous current will be effected by overhead lines on iron poles and wall-brackets throughout the town. The total capacity will be 120 H.P. The concession bears a provisional character and can after the 5th year be withdrawn at one year's notice. Public electric lighting cannot be introduced, on account of the existing contract with the same Company for gas lighting.

Ghiza and Ghezira.

Tenders for the distribution of electricity at Ghiza and Ghezira were invited on May 12th, 1903. The Gas Company alone tendered, but the conditions offered were considered too onerous, especially so far as street lighting is concerned.

The absence of other tenders may be ascribed to the fact that the present number of private consumers would be very small as compared with the area to be provided with distributing lines.

Iskailia.

The deed of concession was signed on February 13th, 1903, and owing to the rapid execution of the work the provisional handing over took place as early as July 30th, and street lighting followed at once. The installations were completed soon after and definitely accepted on November 11th, 1903. At the end of the year, 1785 lamps, representing 63 subscribers, and 175 street-lamps were connected to the Company's lines. The total capacity of the plan is 58 H.P. and 3886 units have been sold.

In this town the street lighting is not paid for by Government, but by the Suez Canal Company: Government is interested in this installation only so far as measures for public safety and regularity of service are concerned.

Suez.

A contract was signed for the lighting of this town on June 10th, 1902, and the installation was to be finished twelve months later. The contracting party, having failed to finish in time, obtained two prolongations. January 1st, 1904 was fixed as the final date of completion.

Actual work had not been commenced, when in September 1903 the concessionnaire asked for permission to transfer his authorization to the "Société Electrique d'Ismaïlia." This demand was granted, subject to the condition, that the installation should be started immediately, and that the fine of L.E. 1 per day should be paid, as stipulated in the original contract, from 1st of January 1904 till the day of completion.

The work is now proceeding.

Tanta.

Authorization was given to M. Nahman in 1901 to erect a large generating station to provide Tanta and Zifta, as well as the neighbouring districts, with electric light and power, but, owing to the want of capital, this project was never executed, and a part of it only, the lighting of Tanta, is being carried out now by the "Société Electrique de la Basse-Egypte" which was formed by M. Nahman for this purpose.

TELEPHONES.

The Telephone Company was authorized to establish a double line between Cairo and Alexandria. Communication was opened to the public in May, 1903 and is being largely patronised. The line follows the railway line throughout its length.

The Ministry of Interior has several times asked for advice concerning the police telephones, and local inspection in the district of Zagazig was undertaken by this Office.

Several complaints from subscribers to the Fayoum telephone installation were submitted to this Ministry by the Mudir. The installations were examined by this Service in November and a report, pointing out grave technical defects and general mismanagement, was submitted.

CAIRO STREET LIGHTING.

In connection with negotiations carried on with the General Manager of the Gas Company and concerning the reduction of price for public lighting in Cairo, a project was elaborated by this Service for lighting by electricity all streets which are not at present lighted by gas. It was proposed that this generating station be worked by Government.

Calculations were based on 6000 incandescent lamps and 300 arc lamps. According to this project the total cost would be L.E. 2,600 per lamp and per annum, as against L.E. 6.75, the present rate per gas lamp.

This project, which would mean an annual saving of L.E. 24,900 on the lighting of the whole city of Cairo at present rates, was submitted to the Ministry of Finance in October.

NEW REGULATIONS.

The regulations drawn up by this Service have been printed and submitted to the Contentieux and the various Administrations and Companies interested.

KASR-EL-AINI HOSPITAL.

The Director General of the Sanitary Department having decided to light this hospital by electricity, our Electrical Service was charged with the preparation of a project and the superintendence of the installation.

It was found more economical to erect a generating station, than to buy the current from the Gas Company. Continuous current of 100 volt was considered suitable, and a suction gas-plant was chosen for driving the dynamo. A battery of 290 amp. hours, was also provided, to supply current during the night.

Tenders were invited on June 11th, and the work placed in the hands of Messrs. Siemens & Halske for the electrical part, and of Messrs. Nahman & Co. for the motor and suction gas-plant.

Over 500 lamps and 2 contact boxes for X ray treatment were installed.

The hospital building, Lady Cromer's Home, the Sisters' house, the Medical School and the Director's house are connected to the generating station.

The electrical part was completed on December 16th, whilst the motor plant is still under construction. The output of the dynamo is 20 KW, and the total cost L.E. 1,600.

CAIRO SEWER PUMPS.

Two centrifugal pumps of 25 HP, each have been erected on the old Ismailia Canal for pumping the rain water and street-drainage into this canal. The pumps are driven by two single-phase motors from the Gas Company's mains, the high tension current being transformed at the pumping station by our own transformers.

In case of heavy rainfall, these pumps are capable of discharging 4000 cubic metres of water per hour. They were used for the first time on December 24th when they discharged the whole of the street water during a rainfall of $3\frac{1}{2}$ hours.

Since April 1903, except during June and July, these pumps have worked once or twice every week, to discharge the surface water accumulating in the pipes.

The cost of ordinary pumping is high and it is proposed to use a wind motor for all work except pumping out rain water. On the night of 11th-12th September the lake in the Esbekieh Garden, containing 3000 c.m. of water and mud, was emptied into the drains, and considerable trouble was caused at the pumping station by the thousands of small fish entering the pipes and choking the strainer. The fish had to be removed by hand.

TABLE SHOWING THE WORK OF THE PUMPS DURING THE YEAR.

MONTH.	Times.	Hours.	Amount of water pumped	K W has consumed	REMARKS.
			C. M.		
March... ..	2	2	—	80	Tests (without water)
April... ..	2	2	2380	34	
May	5	3	3780	51	
June	—	—	—	—	The canal was dry (low water).
July	1	$\frac{1}{2}$	280	1	
August	4	2	2240	32	
September	8	$\frac{1}{4}$	7560	106	Emptying of lake in Esbekieh Garden.
October	6	$\frac{1}{2}$	6850	98	
November	4	$\frac{1}{2}$	6800	94	
December	12	$18\frac{1}{2}$	21250	308	1 torrential rainfall
Total	44	45	51140	810	

MINOR INSTALLATIONS.

Installations in public buildings, mentioned in last year's report, were, as before, controlled and supervised by this Service. The following new installations were added:—

Museum.—The fire-alarm bell was removed from the front to the police sub-station behind the main building. The 15 copper wires were carried to the roof, where they follow the coping, supported on insulators carried by wooden brackets and poles.

46 lamps and wall-plugs were fitted in the Secretary's house and electric bells in the house of the Director.

Ministry of Justice and Foreign Affairs.—50 incandescent lamps and ventilators.

Post Office Building.—25 lamps and electric bells in the Director's residence.

Lunatic Asylum, Abbassia.—An electric pumping plant of $\frac{7}{8}$ HP. was connected to the generating station, for pumping water into a reservoir of 100 cubic metres capacity and 12 metres height.

Khedivial Library.—Specifications have been prepared for 6 arc lamps and 40 incandescent lamps. The installation will soon be completed by Messrs. Thos. Cook & Son, for the sum of L.E. 108,500 Mills.

GHIZEH SERVICE AND EZBEKIEH GARDEN

HELWAN WATER

GHIZEH AND GHEZIREH WATER SERVICE

(MR. CURTIS)

A new 25 c/m main has been laid to supply the new Ghezireh Garden, this has greatly improved the whole service north of the pumps, as, since this main was opened, we have no complaints of want of pressure.

A new pumping station was erected below the English bridge with a new compound 65 H.P. semi-portable engine and a 35 c/m Dumont centrifugal pump for the irrigation of Ghezireh. The total cost of this installation was : L.E.1,290.

The old pumping station on the Nile bank for which the above is a substitute has been demolished and the road widened, thus considerably improving this promenade.

The large compound horizontal engine was removed from this station where the area to be dealt with was not large enough to allow of its developing its full power and was erected in Ghizeh, where it will drive a Dumont 50 c/m centrifugal pump. When completed this pump will supply the whole of the low pressure water required by the Ghizeh Service.

Special work to the amount of over L.E.5,000 has been executed by the Ghizeh Workshops at the request of the Departments interested : I may mention the complete installation of the chemical and physical laboratories, including their complicated gas and water fittings, furniture, desks, etc., for lecture and class rooms, museum, etc., etc., of the Agricultural College. The Chemical Laboratory for the Khedivial Agricultural Society was executed on the same lines. For the Geological Museum, show cases, desks and tables were made.

SUPPLY OF WATER.

Government account	L.E. 5,709	232
HH. Prince Hussein and Princess Fatma		
Hanem ... ..	.. 661	482
Private persons ... ..	.. 886	721
Town of Ghizeh ... ..	.. 176	378
Total... ..	<u>L.E. 7,433</u>	<u>813</u>

ORDINARY EXPENDITURE GHIZEH AND GHEZIREH.

Salaries... ..	L.E. 1,669	185
Coal... ..	.. 2,067	726
Oil, tallow, waste, etc... ..	.. 137	975
Sundry stores ... ..	.. 374	937
Total... ..	<u>L.E. 4,249</u>	<u>823</u>

EXTRAORDINARY EXPENDITURE.

New office	L.E. 48	729
Boring for water ... ..	.. 117	821
Separate water service to new Ghezireh		
Garden ... ..	.. 281	784
Purchase of water meters ... ..	.. 184	982
Purchase of cast iron pipes ... ..	.. 623	751
Total... ..	<u>L.E. 1,287</u>	<u>067</u>
Total expenditure... ..	<u>L.E. 5,536</u>	<u>890</u>

Statement of work executed in the Ghizeh Workshops for the year 1903, not including repairs to the Ghizeh and Ghezireh Water Services.

General Tanzim	L.E. 172	110
Survey Department... ..	.. 385	214
E-bekieh Garden ... ..	.. 188	024
Ghizeh Nursery ... ..	.. 97	358
Sanitary Department ... ..	.. 349	073
Helouan Water Service ... ..	.. 178	184
Agricultural Society ... ..	.. 66	898
Agricultural Society Chemical Laboratory... ..	.. 179	054
Agricultural College, Laboratories and School Fittings	.. 2,105	026
Agricultural College Sundries ... ..	.. 52	995
Benha Bridge ... ..	.. 25	843
Cairo Tanzim ... ..	.. 410	720
Local Commission (Assouan)... ..	.. 155	815
Sporting Club (Ghezireh) ... ..	.. 172	001
New Polytechnic ... ..	.. 182	701
Old Polytechnic ... ..	.. 23	629
Anglo-American Hospital ... ..	.. 103	901
Sundries ... ..	.. 189	708
Total... ..	<u>L.E. 5,038</u>	<u>254</u>

HELWAN WATER SERVICE

This Service has been working well throughout the year, an ample supply of water being given.

Two local bores were sunk at the pumping station to a depth of 50 metres without finding good water.

Projects for filter beds are now completed and will, I trust, be executed in 1904.

EXPENDITURE AND RECEIPTS FOR 1903.

Water sold to private persons (by 510 water meters)...	...	...	...	...	...	...	...	M ³ 164,048
On Government account	...	...	...	...	...	...	...	.. 117,441
Total...	...	...	...	...	...	...	...	<u>M³ 281,489</u>

Detailed Government account :

Local Commission	...	...	...	...	M ³ 72,493
Baths and Hotel	...	...	...	...	.. 16,978
Tanzim and Police	...	...	...	...	.. 11,420
Midan Said...	...	...	...	...	.. 9,283
Station Garden	...	...	...	...	.. 1,632
Flushing pipes	...	...	...	...	.. 5,635
Receipts : Total...	...	...	...	...	<u>M³ 117,441</u>

From private persons	...	...	...	...	...	...	...	L.E. 2,394 687
Government account	...	...	...	...	...	...	...	.. 1,468 012
Total...	...	...	...	...	...	...	...	<u>L.E. 3,862 699</u>
Total Expenditure...	...	...	...	...	...	...	...	L.E. 1,788 533
Total Balance...	...	...	...	...	...	...	...	<u>.. 2,074 166</u>

NOTE.—Included in the sum of expenditure is L.E. 90 paid for boring operations.

SECTION No. 4.

The roads on this Section are all in fair condition. This year 6,905 M² of new road has been made, and must be added to the area of macadam. 15,399 M² of road have been macadamized with the steam roller at a cost of L.E. 1,678, which works out to about 35 m/m per square metre.

Ordinary repairs to roads with pimmers and repairs to trottoirs have cost L.E. 766, making a total expenditure for the year on this Section of L.E. 2,444.

GHIZEH NURSERY AND TREES IN SECTION NO. 1.

In 1903, 4,045 trees were supplied by the Nursery and 39,265 pots of different kinds of flowers. At the Horticultural Show in March and Chrysanthemum Show in November the Service was very successful, obtaining two special gold medals and other prizes.

I have already reported on the condition of the trees in Section No. 4. Trees and branches that have fallen down or had to be removed, owing to their dangerous condition were sold in 1903 for over L.E. 200.

Statement of Receipts and Expenditure for the Ghizeh Nursery and Trees in Section No. 4 for 1903.

TREES, SHRUBS AND FLOWERS SUPPLIED TO GOVERNMENT GARDENS, CAIRO.

Ezbekieh Garden.

Shrubs and trees...	...	...	...	...	...	...	...	...	1,245
Flowers in pots	...	...	...	...	...	...	...	...	8,510

Cairo Tannin.

Shrubs and trees...	...	...	...	...	...	...	...	...	1153
Flowers in pots	...	...	...	...	...	...	...	...	29,785

Governorat Damietta.

Trees	200
-------	-----	-----	-----	-----	-----	-----	-----	-----	-----

Lamatin Asylum.

Trees	50
-------	-----	-----	-----	-----	-----	-----	-----	-----	----

Military School.

Trees	...	...	...	...	...	...	...	...	116
Flowers in pots	...	...	...	...	...	...	...	...	499

Section No. 4.

Trees	120
-------	-----	-----	-----	-----	-----	-----	-----	-----	-----

This represents a total sum of	...	...	...	...	...	...	L.E.	618	660
To private persons, trees 1,161	...	...	...	...	...	...	"	71	260
To private persons, flowers 469	...	...	...	...	...	...	"	8	835

L.E. 698 755

Sale of timber from Section No. 4	"	466	200
-----------------------------------	-----	-----	-----	-----	-----	-----	---	-----	-----

Total... L.E. 1,164 955

EXPENSES.

Salaries	...	...	...	...	...	...	...	...	L.E. 655 015
Stores and tools	...	...	...	...	...	...	...	...	" 167 907
Watering and other carts, etc.	...	...	...	...	...	...	...	...	" 169 475

Total... L.E. 992 397

REPORT ON THE ESBEKIEH GARDEN FOR THE YEAR 1903.

Attached is a statement of receipts and expenditures.

The lake has been filled in and its bed raised 40 c/m above the garden level. Owing to the excellent arrangements made by Mr. Curtis the whole of the material required, 9,275 cubic metres, was obtained gratis from carters desirous of getting rid of old building material. The filling by contract would have cost L.E.500. Trees will be planted on the site and the whole space arranged as a playground for children. The gate receipts are L.E.80 in excess of 1902, while L.E. 100 has been economised on water.

ESBEKIEH GARDEN, 1903.

RECEIPTS FROM GATES...	L.E. 1,261	382
------------------------	------------	-----

EXPENSES:

Salaries gate clerks, garden rangers...	L.E.	342	321
English Band...	..	158	000
		<u>L.E.</u>	<u>500 321</u>

ESBEKIEH GARDEN.

Gas ...	L.E.	346	758
Water ...	..	544	449
Salaries ...	..	783	790
Native Band ...	..	302	000
Carts ...	..	49	165
Stores, repairs, etc. ...	..	332	030
Cleaning cesspools ...	..	25	852
Total...	<u>L.E.</u>	<u>2,384</u>	<u>044</u>
Budget...	..	2,484	000

REPORT ON THE SURVEY DEPARTMENT

For 1903

BY

CAPT. H. G. LYONS,

DIRECTOR-GENERAL, SURVEY DEPARTMENT.

THE SURVEY DEPARTMENT REPORT, 1903

REVENUE SURVEY.

The Revenue Survey was carried on in 1903 in Qaliubia and Daqahlia provinces: the former was completed by July and the latter by January 1904. By the end of the summer a part of Qena Mudiria was begun and directly after the flood had subsided the whole province was taken up. In October the Finance Ministry notified that all village registers of Upper Egypt must be completed before the end of January each year instead of the end of March. This has made a great difference since under the first arrangement complaints could be investigated and errors corrected after the flood, but now all must be completed before it. To carry out this new programme an increase of about 50 surveyors will be necessary in 1904, and the two following years.

I would also draw attention to a point to which I shortly referred in the report for last year: ⁽¹⁾ at present a survey is being carried out on a scale of 1:2500 which technically is as accurate as the European surveys of the same character, since the scale of permissible errors is the same as that allowed in the Austrian, French and German cadastral surveys. The correctness of the boundaries of individuals' holding is not so great since there is no law which requires a landowner to mark his limits, or to appear and point out his boundaries at the time of survey, but whenever they are indicated an accurate survey of them can be guaranteed. On this survey a sum of about L.E. 50,000 is being spent annually.

Copies of the maps when completed and printed are handed over with the land registers to the Ministry of Finance and are deposited at the Mudiria. Sales of land are constantly taking place, but there is no accurate system of keeping the maps, which were accurate, up to date; the surveyors at the Mudiria are not sufficiently trained to carry out the work, and I believe that there is no technical supervision to oblige them to do it correctly. Thus in a few months the map no longer represents the actual state of the properties, and the mutation register, being kept up from the data provided by these untrained employés, is

⁽¹⁾ Public Works Administration Report 1902 p. 352.

of no use in any revision of the map. Thus the yearly expenditure must go on indefinitely and before any province is revised, I suppose at least 10 or 12 years must pass. For probably the last five of these the maps will not be of much use.

I believe that for an average annual expenditure of L.E.2,000 per Mudiria these maps could easily be kept up to date and all official measurements for expropriation, etc., made; the periodical revision of maps and registers would be much quicker and cheaper since there would be a map corrected up to date. A cadastral office in each Mudiria would be necessary and they should be technically supervised in order to keep the work up to the necessary standard of accuracy. If registration of title is introduced some such arrangement will be necessary. It could be introduced now, as each Mudiria is finished without difficulty and without in any way delaying the work of the present survey.

In the Instruction Class 59 surveyors have been trained to fill the places of men who resigned or who were dismissed as not up to the required standard, 36 in number.

A considerable amount of work is done also in examining surveyors and draughtsmen for other administrations; in the 14 months ending February 1904, 33 were examined for the Government Lands Department, and 17 for the Sudan Government.

The technical library of the Department has increased considerably during the year:—

	Books and Pamphlets,	Maps
In the Library 1st January 1903	2,656	731
Purchased	187	17
Presented	348	36
In the Library 31st December 1903 ...	3,191	784

The sale of maps and publications which has been steadily increasing for some years past, increased very markedly during 1903, and a still further increase is probable in 1904 since small landowners will now be able to get copies of the maps they require from the survey parties working in their neighbourhood.

YEAR.	Printed maps.		Publications.		Tracings.		Total.	
	L.E.	M.	L.E.	M.	L.E.	M.	L.E.	M.
1901	214	9	48	8	537	6	801	3
1902	292	0	90	2	628	9	1011	1
1903	874	6	122	3	724	2	1721	1

The Map Store has already to be enlarged and a sale room must be built where applicants can consult maps and purchase them.

STATEMENT OF PRINTED MAPS, ETC., IN MAP STORE.

	Maps.	Publications including meteorological monthly sheets.
In Store 1st January 1903	216,095	91,063
Received during 1903... ..	323,068	74,740
Issued during 1903	135,888	32,552
In Store 31st December 1903	403,276	133,251

The issues have largely increased showing that a fuller use is being made of maps, both by Government Departments and by the public.

ISSUES.

YEAR	MAPS.		PUBLICATIONS.	
	Free (¹)	On payment.	Free (²)	On payment.
1901	24,550	2,847	9,009	235
1902	88,086	4,137	15,847	801
1903	122,817	13,071	30,904	1,648

(¹) To Government Departments

(²) Mostly monthly meteorological observations sent to Government Departments and to other Services and Observatories.

THEODOLITE TRAVERSING.

The improvement recorded in last year's report has been well maintained, though circumstances have tended to raise the cost. Communication in Upper Egypt is not so easy as in the Delta, and the alteration of the programme by the Finance Ministry, which has already been mentioned, has necessitated training 20 new traversers whose work is slow at first. The work done is shown in the following table:—

SUMMARY OF TRAVERSE WORK DONE IN 1903.

No. of triangles	Avg. day (1894 to 1902)	Avg. day (1894 to 1903)	Cost (1894 to 1902)	No. of triangles per day worked	No. of triangles per day worked	Points per square kilometre	Points per square kilometre	Length in kilometres	Cost in £
Delta	116.115	188	17.55	5.125	1.062	10.5	12.53	588	115
Qena	392.106	1.617	5.743	19.396	2.647	11.7	7.27	2,636	105
Assuan	28.664	120	9.15	3.773	.531	31.1	7.10	711†	189‡
Giza	29,628	124	144	1.995	.220	15.2	8.5	337	173
Total	566,513	2,379	8,867	30.150	4,460	12.7*	6.75*	3,672‡	122*

* Average.

† The cost of Assuan does not include travelling and freight charges on the War Department boats.
‡ L.E. 3,743 added which was actually spent in Qena.

In comparison with previous years these data are:—

	1901	1902*	1903
Cost per square kilom. L.E.		1.708	1.540
Cost per point... ..		0.123	0.122
Points per square kilom.	16	13.8	12.7
Kilometres chained per square kilom. ...	4.00	4.13	3.7
Average number of points per surveyor per day	6	5.5	6.75
Average length chained metres per day ...		1653	1980

* The figures given in last year's report are incorrect and should be as now given.

The accuracy of the work has been consistently good. Considerable trouble was caused at first by the removal of marks, but this was

reduced by the local authorities, after a short time though a good deal of it still goes on.

TRIANGULATION.

During the year the major triangulation of about one-third of Qena and Girga, and of Aswan from Dakka northwards to Esna was completed, but the comparative want of economy of the method necessarily adopted in the Nile Valley (that of triangulating a strip of quadrilaterals connecting points on the escarpment on each side), was markedly felt. In consequence it was found impossible to complete the major triangulation from Dakka to the frontier. The Revenue Survey accordingly was based on the minor triangulation only in this district. The accuracy however, is more than sufficient for the wants of the Revenue Survey. In pursuance of the general plan * bases were measured at Addenda, Dakka and Khattara. The measurement of the latter was only completed early in 1904, but since it falls more naturally into place in connection with the work of last year, it is referred to here. A base was also measured at Tema for the Girga triangulation.

Chiefly owing to the fact that the requisite staff of inspectors for using the Jäderin apparatus could not be spared at one time, it was decided to measure these four bases with the 100-metre steel tape already employed for the Fayum base, but experience with it seems to indicate that the risks of error with the wires are less than with the tape. The latter demands extremely calm weather for the best results, a state of things which it seems impossible to look for in Upper Egypt during the winter months when the tape can otherwise be most successfully employed.

The general arrangement of the measurement has been as follows : The base is subdivided into two or three sections of from 700 to 900 metres each which are measured separately. Each section is laid out in 100-metre lengths marked by stout stakes to which a fiducial mark is attached. Every 20 metres a light staff carrying a roller on the top is placed to support the tape. The tops of the rollers are carefully graded so that the slope from one stake to the next is preserved. In the actual measurement the distance from the ends of the tape-length to the marks on the stakes are measured and the tension and temperature read. The tape is then slightly disturbed and a new set of

* See Public Works Ministry Report 1902, p. 356.

readings taken. These small distances were read in different ways at different bases, but the method found most successful was to nail to the stakes strips of zinc 30 centimetres long on which millimetre scales had been engraved.

During the year an error in the computation of the Gebelén and Ambir bases was discovered, fortunately in time to allow the necessary corrections to be made for ensuring the accuracy of the maps of Qena Mudiria, which alone was affected. The revised results for these bases are now * :—

	Metres
Gebelén	2304.686
Ambir	2323.727

The cost of the major triangulation was :—

	L. E.	M
Personnel... ..	1,303	870
Transport and marks	615	011
Measurement of bases	148	
Total... ..	<u>L.E.2,066</u>	<u>881</u>

for which 4,100 square kilometres were triangulated.

STATISTICAL DETAILS.

MAJOR TRIANGULATION.

	Daqahla, Qalubia	Qena.	Girga	Aswan.	Assiut.
Extent in square km.	2,950	1,277	1,441	2,662	—
Time taken in days	270	153	165	270	70†
Stations occupied	41	29	21	31	—
Lines observed	93	86	48	73	—
Triangles	48	66	46	56	—
Average length of side (metres)	15,000	15,000	16,000	17,000	—
Cost L. E.	1,290	599	612	804	216
Cost per square km. L. E. ...	0.437	0.469	0.425	0.302	—
Cost per station L. E.	31.5	20.7	29.1	25.9	—
Average error of closure of triangles	2".4	2".19	3".04	2".18	—

* Cf. Public Works, Ministry Report 1902, p. 356.

† Reconnaissance only.

MINOR TRIANGULATION.

Except in summer four parties were steadily at work. The area covered extended over half of Qena and Girga and the whole of Aswan.

The total cost was :—

	1903
	L.E.
Personnel	1,460
Transport	455
Marks,	43
	<u>1,958</u>

for which an extent of 4,200 square kilometres was triangulated.

MINOR TRIANGULATION.

	Qena 1903.	Girga 1903	Aswan 1903.
Extent in square km.	897	1,141	2,117
Time taken (days)	307	366	422
Stations occupied	191	187	286
Lines observed... ..	351	470	725
Triangles	286	251	288
Average area in sq. kilom.	3.2	3	5
Average length of sides, metres	3,200	3,000	4,500
Cost L.E.	439	751	659
Cost per sq. kilom L.E.	0.490	0.659	0.311
Average error closure of triangles	3".3	3".2	2".5

The computation work has been similar to that of the previous year. Improvements in the methods of checking have, however, been introduced, so that every step of the work is now checked, either by computing backwards direct from the final results to the observed values where that is possible, or by independent computation where the other method is unavailable. The plotting of the map-sheets is further checked by a repetition of the process independently.

COMPUTATION OFFICE STATISTICS.

	1901	1902	1903
Points computed...	43,000	53,136	31,980
Length of lines computed .. Kilom.	—	12,142	9,500
Sheets plotted ..	2,500	5,026	4,968
Area computed ... Fedd.	—	875,941	714,132
Villages computed ...	—	510	302
Total cost ... L.E.	—	2,079	2,303
Cost per feddan ...	—	238	322

Exclusive of 2,000 points for the topographic work of the survey work.

The falling off in the area computed is due almost entirely to the effect of the Nile flood in stopping field operations ; also the area given is the actual area inside the boundary lines of the villages as derived from the work of the survey and is not estimated as was the case in former years.

The number of points computed is less since in former years points on the village boundaries were computed twice, once in each village ; as the work became more organised this extra computing, which was unnecessary, was avoided. The time economised in this way enabled the Computation Office to furnish all the taffishes with the areas of the villages inside the boundary lines, to be used in checking the area found from the sum of the individual holdings.

The astronomical computations for the almanacs were made as usual. There is evidence that as the Government Almanac is becoming better known its usefulness is increasing. Several additions were made to that for the current year which was published in November.

With the exception of the computers in the triangulation section, there is not a computer in the office who has had any previous mathematical training except in the elementary rules of arithmetic. Owing to the absence of any institution in Cairo where the requisite instruction can be obtained in the hours at the disposal of the employes of the Department, it has been necessary to train the whole of the junior staff, and in some degree, the senior also, in the office.

FIELD SURVEY.

At the beginning of 1903 both Qaliubia and Daqahlia Mudirias were in hand, and both were completed during the year, the total area completed during the year being 752,000 feddans which is the largest area hitherto completed in any one year. Together with the increased rate of work, there has also been a steady reduction in the cost per feddan during the last two years, both in field and record work.

YEAR	Cost of field work, 100 per feddans	Cost of record work, 100 per feddans.	Total cost per 100 feddans.
	L. E. M.	L. E. M.	L. E. M.
1901	1 428	1 154	2 582
1902	1 400	0 700	2 100
1903	1 129	0 603	1 732

This reduction of cost, as also the large area completed during the year, is partly due to the large areas of "barari" lands in Markaz Dekernis, and also to the 'Kharig-el-Zimam' lands in Markaz Nawa, Qaliubia.

On January 1st 1903, there were 91,000 feddans under survey in Qaliubia Mudiria, and by May the whole Mudiria was completed.

The total deficit in the Mudiria was not as large as was anticipated owing to the excess along the edge of the desert and in Kharig-el-Zimam lands referred to above, which balanced to a large extent the deficits which there would otherwise have been.

In Daqahlia Mudiria there were 248,000 feddans under survey at the beginning of the year.

The whole of this Mudiria was completed by the end of the year, that is to say the 248,000 feddans above mentioned were completed, and 402,240 feddans were begun and completed during the year.

The first villages in Qena Mudiria were taken up in September 1903 and subsequently the whole Mudiria, except 12 villages was taken up in the field before the end of the year.

Thus the area carried forward at the end of the year as partially completed, namely 337,952 feddans, almost exactly balances the area brought forward partially completed at the beginning of the year, i.e., 339,942 feddans. This bears out the figure given for the out-turn of the year, i.e., 752,000 feddans.

STAFF EMPLOYED ON REVENUE SURVEY.

STAFF	REVENUE SURVEY	TRAVEL SECTION
Chief Engineers	9	1
Engineers	32	9
Assistant Engineers	17	—
Messahin	250	24
Computing and Checking	28	—

AREAS SURVEYED IN 1903.

MARKAZ.	1902-3		1903		1903-4		Total	Remarks
	No. of Villages	Feddans.	No. of Villages	Feddans.	No. of Villages	Feddans.	Feddans.	
Dawahi Masr ...	12	14,603	1	1,403	—	—	16,006	Areas given in column 1903-4 are approximate only.
Qaliub... ..	30	47,073	5	9,495	—	—	56,568	
Nawa	17	45,880	—	—	—	—	45,880	
Tukh	35	57,305	—	—	—	—	57,305	
Fareskur	21	36,675	3	13,399	—	—	50,074	
Mit Ghamr... ..	5	7,040	57	64,254	—	—	71,294	
Mit Samannud ...	—	—	67	71,726	—	—	71,726	
El Simbellawen...	22	36,269	35	63,407	—	—	99,667	
Mansura	51	69,888	2	2,497	—	—	72,385	
Dekernes	15	21,990	57	183,226	—	—	205,216	
Shibin el Kom ...	1	3,228	—	—	—	—	3,228	
Kafr Saqr	—	—	1	3,732	—	—	3,732	
Deshna... ..	—	—	—	—	15	60,517	60,517	
Esna	—	—	—	—	17	47,037	47,037	
Luxor	—	—	—	—	16	68,922	68,922	
Nag Hamady ...	—	—	—	—	19	49,814	49,814	
Qena	—	—	—	—	20	51,029	51,029	
Qus	—	—	—	—	27	60,633	60,633	
Total... ..	—	339,942	—	413,139	—	337,952	1,091,033	

TIME AND COST OF REVENUE SURVEY PER 100 FEDDANS.

MARKAZ.	No. of Villages	Area in Feddans	Days per 100 feddans.		Cost per 100 feddans.			
			Field W. ork.	Records.	Field Work.		Records.	
					L.E.	M.	L.E.	M.
Nawa	17	45,880	2·6	1·5	0	637	0	287
Dawahi Masr	13	16,006	5·3	2·5	1	232	0	402
Qaliub	35	56,568	5·0	2·8	1	051	0	502
Tûkh	35	57,305	7·3	5·2	1	594	0	670
Mansura	53	72,385	4·1	2·4	0	944	0	425
Dekernes	72	205,216	3·6	1·6	0	737	0	239
Fareskur	24	50,074	4·7	2·6	1	065	0	342
Mit Ghamr	62	71,294	6·4	5·2	1	278	0	799
Mit Samannud	67	71,726	3·4	2·9	0	849	0	499
El Sinbellawen	57	99,667	5·5	1·4	1	156	0	275
Shibin el Kom	1	3,228	8·4	14·1	1	875	1	895
Kafr Saqr	1	3,732	4·3	3·4	1	447	0	299
Average... ..			5·05	3·80	1	155	0	553
Average in 1902			5·92	5·04	1	400	0	700

AVERAGE SIZE OF PLOT.

MARKAZ	Number of Villages.	Total No of Plots	Plots under 12 qads	Percentage	Plots under 5 feddans and over 12 qads	Percentage	Plots over 5 feddans	Percentage
Etsa	31	40,080	15,655	39·1	21,072	52·6	3,353	8·3
Fayum	25	39,469	18,474	46·8	18,781	47·6	2,214	5·6
Sannures	29	45,576	20,412	44·8	22,443	49·2	2,721	6·0
Shibin el Kom... ..	60	58,904	22,431	38·1	35,128	59·6	1,345	2·3
Menuf	58	62,107	21,158	34·1	39,478	63·5	1,471	2·4
Quesna	61	38,005	10,499	27·6	24,718	65·0	2,788	7·4
Ashmun	32	31,362	11,233	35·8	19,049	60·7	1,080	3·5
Tala	35	53,767	18,965	35·2	32,515	60·5	2,287	4·3
Nawa... ..	41	25,976	9,589	36·9	14,545	56·0	1,842	7·1
Dawahi Masr	14	4,830	1,667	34·5	2,522	52·2	641	13·3
Qaliub... ..	35	17,560	4,653	26·5	11,235	64·0	1,672	9·5
Tukh	59	40,417	16,452	40·7	21,849	54·1	2,116	5·2
Dekernes	72	51,092	20,634	40·4	26,692	52·2	3,766	7·4
Fareskur	36	11,109	3,483	31·3	5,551	50·0	2,075	18·7
Mansura	63	25,090	7,625	30·4	15,315	61·0	2,150	8·6
Mit Ghamr	81	35,819	10,672	29·8	21,769	60·8	3,378	9·4
Mit Samannud... ..	67	25,073	6,542	26·1	16,248	64·8	2,283	9·1
El Simbellawen	83	35,828	9,397	26·2	21,725	60·7	4,766	13·1
Embaba	35	32,891	9,852	30·0	20,758	63·1	2,267	6·9
Giza	25	12,765	3,546	27·8	7,141	55·9	2,078	16·3
Ayat	17	15,385	7,356	47·8	7,199	46·8	830	5·4
Saff	26	20,868	6,803	32·2	12,925	61·9	1,140	5·5

Besides this large scale survey primarily for revenue purposes an attempt has been made during the past few years to produce topographical maps of Egypt on scales of $\frac{1}{100,000}$, $\frac{1}{50,000}$ and also a general map on the scale of $\frac{1}{250,000}$. The sum allotted has hitherto been but little, though Government Departments are constantly asking for these maps. Certain portions have been surveyed with funds provided by the Irrigation Service, but this is most uneconomical, as survey parties are being moved from point to point to take up different areas at short intervals of time, and thus both time and money are wasted.

The area is revised in the field for publication on the scale of $\frac{1}{100,000}$ and from these the $\frac{1}{500,000}$ sheets will be reduced. The following table shows a creditable result for the small staff of 18 young Egyptian surveyors, all of whom have been trained in the Department, under Messrs. Dowson and Weldon, the inspectors in charge. At the present rate it will be a long time before Upper Egypt gets any topographical maps and unless more funds are allotted to this work.

TOPOGRAPHICAL REVISION IN 1903.

PROVINCE.	No. of maps done in the year	Area of map in sq. km.	Total area revised in sq. km.	Men working days.	Working days per map.	Sq. km per working day.	Total cost in L. E.	Cost per sq. kilom.
								L. E. M.
Bohera . . .	49	25	1,225	955	19.5	1.28	692	0.565
Gharbia . . .	150*	24	3,600	2,539	16.9	1.42	1,230	0.342
Giza . . .	8	19.2	153.6	124	15.5	1.24	135	0.876
Total	207		4,979	3,618		1.37	2,057	0.412

* Calculated as 150 full sheets but more actual sheets were supplied

TOWNS FINISHED IN SURVEY BEFORE END OF 1903.

NAME OF TOWN	No. of traverse marks	A. Close Town.	B. Open Town.	C. Country	Town area (A+B)	Traverse marks per Sq. kil. of town area	Total cost	Cost per square kilom.	No. of men working days.	Working days per square kilom.
		Sq. M.	Sq. M.	Sq. M.	Sq. M.		L. E.	L. E.		
Suez	—	—	—	—	—	—	134	—	247	—
Helwan	85	—	—	—	—	—	43	—	78	—
Mit Ghamr. . .	205	2,441,240	108,140	184,030	322,380	637	132	410	247	767
Mansura	915	832,803	739,405	585,578	1,572,208	582	398	253	1,144	728
Total	1,205						707		1,716	

N.B.—Suez and Helwan were only partial surveys

Drawing Office. — In the Drawing and Lithographic Offices work has been carried on similarly to last year. The cost of autographing and printing a revenue survey map sheet about 44 cm. × 48 cm. is

Tracing, writing, correcting	... ..	325	Mill.
Transferring, proving, printing	... ..	50	..
Materials including zinc sheet	... ..	90	..
Total...	...	465	Mill.

Paper is not included, as the number printed varies considerably according as parts of one or more villages occur on the same sheet.

The cost is slightly less than last year.

The topographical maps are fair drawn from the revised field sheets and then lithographed and printed in 3 or 4 colours.

The cost of the production of these sheets is as follows :—

TOPOGRAPHICAL. 1906

	Behera.	Gharbia
<i>Drawing Office.</i>	m/m	m/m
Drawing	2571	3336
Compiling		
Examining		
<i>Lithographic Office.</i>		
Lithographing	1210	1565
Correcting		
<i>Printing Office.</i>		
Proving	2599	3517
Printing		
Paper		
Zinc, etc... ..		
	6380	8418
Single sheet	42.5	42

This cost is rather above that reported last year, but is a more correct estimate, as it includes several small items which could not be accurately included in last year's estimates.

The preparation of $\frac{1}{500000}$ sheets is in hand, but want of funds prevents their publication at an early date. They are reduced by

photography from the $\frac{1}{10000}$ sheets to $\frac{1}{30000}$; blue prints on this scale are then prepared and these are drawn up for final reduction to $\frac{1}{50000}$.

The staff of the Drawing Office was :—

	European.	Egyptian.	Total.
Superintendents	4	1	5
Lithographers	7	2	9
Authographers	—	18	18
Draught-men, 1st class	2	6	8
„ 2nd „	2	9	11
Arabic writers and typers... ..	—	7	7
Printers	4	3	7
Assistant printers... ..	—	11	11
Assistant photographers	1	—	1
Mounters	—	2	2
Boys	1	7	8
Clerks	—	2	2
Total... ..	21	68	89

STATEMENT OF MAPS AND PLANS PRINTED.

	1902.	1903.	Total copies. in 1903.
		Number.	
Revenue survey map sheets	4,348	4,328	259,680
„ „ reprinted	—	1,331	33,275
Topographical maps $\frac{1}{100,000}$	121	168	29,600
„ „ other scales	—	23	4,650
Departmental maps and plans	30	96	33,190
Extra-departmental maps and plans... ..	31	17	13,500
Tracings Departmental	185	—	247
„ on repayment	661	—	927
Circulars and forms	—	—	150,000
Line and half tone blocks	—	17	6,560

The geological staff were employed on measuring the discharges of the Upper Nile at Khartoum and Ducim, and each inspector was occupied in this work for about five months. In the remainder of the year Mr. Barron revised the geology of the country between Cairo and Suez, while Mr. Beadnell continued collecting the fossil remains from the Upper Eocene beds near the Fayum. Dr. W. F. Hume was fully occupied with the arrangement of the Museum collection.

During the year reports on a part of the Eastern Desert and on Baharia Oasis have been published.

An arrangement has been concluded by which the Trustees of the British Museum will include in the monograph they are about to publish, full descriptions of the Eocene Vertebrata which have been collected during the last two or three years from the desert north-west of the Fayum. By this means the whole of the material both in Cairo and in London will be described in the same monograph. Dr. C. W. Andrews has been detailed by the Director of the British Museum Natural History Department for this work.

Meteorology.—New stations were equipped during the year at Mongalla and Ghaba Shambe on the Bahr-el-Gebel, at Wau on the Bahr-el-Ghazal, at Doleib Hilla and Nasser on the Sobat and at Abbassia Hospital to preserve the continuity of the observations there when the Observatory is moved to Helwan. Rainfall stations were established at nine places in Behera Province.

It may be useful to mention here the present position of the meteorological services in Egypt and the Sudan at the end of 1903.

1st Order Station.—Fully equipped with self-recording instruments for registering continuously all meteorological phenomena. Abbassia Observatory, Cairo.

2nd Order Stations.—Recording atmospheric pressure, temperature, humidity, rainfall, wind by means of observations taken twice or thrice daily.

EGYPT.

Alexandria	Abbassia Military Hospital
Port-Saïd	Giza
Assiut	Aswan

SUDAN.

Wadi-Halfa	Suakin
Berber	Khartoum
Wadi Medani	Dueim
Mongalla	

Climatological Stations.—Recording temperatures, humidity, rainfall, wind.

EGYPT.

Beni-Suef

SUDAN.

El-Obeid	Kassala
Wau	Doleib Hilla (American Mission Station)

ABYSSINIA.

Addis Abeba

Rainfall Stations.—Recording rainfall and wind.

EGYPT.

Mersa Matruh	Mex
Teh-el-Barud	Damanhur
Abu Hommos	Kafr Dawar
Hosh Issa	Atfih
Shubrakhit	Kafr Bulin
Khatatba	

SUDAN.

Gallabat	Erkowit
Gedaref	Khashm-el-Girba (Atbara)
Kodok	Nasser.
Ghaba Shambe	

The observations of first and second order stations are printed monthly, and the others annually.

ABBASSIA OBSERVATORY.

In view of the transfer of all the instruments at the end of the year to the new site at Helwan no new work was undertaken during 1903. The self-recording instruments worked satisfactorily throughout the year. The noon Time signal was sent regularly each day by the Standard Mean time Clock, and the Time Ball at Port-Said was dropped by it. At Alexandria the mast of the Time Ball on Kom-el-Nadura broke early in August and by the end of the year it had not been repaired. The Time Ball signal at this port was not, therefore, given automatically during this period.

LABORATORY.

The work of the Laboratory may be divided into four main branches :—

(1) The chemical analysis of various articles for purity, value and conformity to specification ;

(2) The physical examination of cements and hydraulic lines for tensile strength, soundness and fineness of grinding, and the examination of bricks and building stones for crushing weight, etc ;

(3) The testing of scales and weights :

(4) The systematic testing of the public gas supply of Cairo for pressure, purity and illuminating power, and the examination of various burners for consumption of gas and intensity of light.

In addition to the actual chemical and physical examination of samples a certain and a growing, amount of consulting work is also done, technical opinion being frequently asked by various administrations on special points.

In 1903 a total number of 561 samples were examined as compared with 362 samples in 1902 being an increase of 55%. In addition to this the gas testing was entirely new work.

1. Chemical Section.—During the year 288 analyses were made as against 225 in 1902, an increase for the year of 63 samples or 28%. Of these analyses 195 samples (67%) were done for the Public Works Ministry for which no charge is made; 42 samples (14%) for other Government Departments, a nominal fee being charged in each case; and 51 samples (17%) were received from non-government sources for which a regular tariff is in force.

Among the articles submitted for analysis* were 28 samples of well water from various parts of the Delta, all of which were either in actual use or suggested for use as drinking water. Of these only one sample was of really good quality and this was from the edge of the desert on the outskirts of Cairo. Two other samples, however, were passed as potable, although both of them were inferior to a good average sample of Nile water. Thus 89% of the well waters examined were quite unfit for drinking. In some cases the water was simply too salty to be used, but in many cases the water was badly contaminated organically and little better than dilute sewage.

Signal instances of particularly impure waters were (a) samples of water from a sakia and also from a so-called artesian well at Damauhur, and (b) from a well at Zeitun. The one sample of excellent water was also from Zeitun.

2. Physical Section.—A total of 111 samples of cement and hydraulic lime were examined for tensile strength, etc., as compared with 113 samples in 1902, being a decrease of almost 2%; while 162 samples of brick and building stone were tested for crushing strength, etc., against 24 in 1902.

* The analysis is a chemical one only and not bacteriological.

The greater part of these 162 samples, however were typically examples of the various Cairo building stones which were examined for the Geological Museum, so that a full description of each stone might be exhibited with the specimens.

3. *Weights and Scales.*—Weights were examined on several occasions for the Railway Administration and a weighbridge belonging to the War Office was thoroughly tested with various loads from 25 to 500 Kil.

4. *Gas Testing.*—At the beginning of the year a complete set of new apparatus exactly similar to that used at the present time in the Paris gas testing stations was received and erected, and regular and systematic testing was commenced.

From April to December inclusive the gas was examined on 184 different nights.

In April, the first month during which regular testing was done, the mean illuminating power for the month was found to be 19.5 % below that specified in the contract.

As soon, however, as this was brought to the notice of the Company a considerable improvement was at once made, with the result that in May the illuminating power was only 6.9 % below the contract. In June, July and August the illuminating power was 6.1 %, 10.3 % and 4.2 % respectively below the standard, but in each of the succeeding months from September to December inclusive the illuminating power was slightly in excess of that specified.

On three occasions sulphuretted hydrogen, which is prohibited under the contract, was found to be present.

The recorded pressure has always been above the contract requirements, which, however, are fixed very low, except occasionally when the gas has been turned off for a short time.

In December the Gas Company brought out as an independent expert, the chief inspector of the gas service in Paris. This expert, with the permission of the Government, examined the apparatus in use in the Government Laboratory and checked the methods of testing employed, and both he and the Company expressed their entire satisfaction with the manner in which the tests were performed, and also excepting on two very minor points, with the apparatus used, which is exactly similar to that employed in Paris and is supplied by the same makers.

Incandescent Lighting.—In addition to the regular testing of the gas for conformity to contract requirements much other work has been done

on the relative values of the light produced by different incandescent burners and mantles, and also on the intensity of light emitted by incandescent mantles in various stages of efficiency, in order, if possible, to arrive at some satisfactory method of classification that would be of practical use during the nightly inspection of the street lamps by the Gas Service.

The following tables show in detail the amount and nature of the work done during the past twelve months :—

Section	N ^o of samples examined	Fees received
		L. E. M.
Chemical Section	288	49.800
Physical Section	273	36.633
Total... ..	561	86.433

From	N ^o of Samples examined		Fees received.
	Chemical Section	Physical Section.	
Public Works Ministry : —			
Survey Department... ..	91	150	No charge.
Tanzim Department... ..	52	11	
Irrigation Department ...	43	—	
Department of Antiquities	9	—	
			L. E. M.
Ministry of War	15	—	3.000
Railways Administration ...	17	—	3.400
Wakfs Administration ...	—	3	0.300
Sudan Government	9	—	5.000
Army of Occupation	1	—	2.000
Non-Government Sources...	51	109	72.733
Total	288	273	86.433

Nature of sample	Nº of samples examined.	
	Chemical Section.	Physical Section.
Ores, minerals, etc.	47	—
Building stones and bricks ...	—	162
Cements and hydraulic limes	34	111
Paints	3	—
Asphalts... ..	7	—
Lubricating oils	20	—
Drinking waters	28	—
Drainage & irrigation waters	35	—
Soils, etc.... ..	43	—
Manures	12	—
Foods (butter, etc.)	15	—
Miscellaneous... ..	44	—
Total	288	273
Number in 1902... ..	225	137

GAS TESTING

Month	Nº of nights illuminating power tested	Nº of tests made.
April... ..	24	72
May	18	54
June	20	60
July	20	60
August	20	60
September	20	60
October	20	60
November	23	69
December	19	57
Total	184	552

The investigation, begun in 1902 on the soil and water of the Wadi Tumilat lands under reclamation was continued in 1903, but owing to the pressure of the routine analytical work, which increased 55% during the year, it was found impossible to do more than examine a few samples of soil and once a month a sample of the drainage water from the Kassassin pumping station.

One of the samples examined was a heavy clay found to be practically untillable : samples of this were taken from the surface and from depths of 20 cms. and 30 cms. respectively below the surface : in no case did the sodium carbonate amount to more than 0.8 per cent, but

even this small amount was sufficient to make the soil sticky and to account for the difficulty experienced in working it.

The following were the results obtained:—

Laboratory No	Depth	Moisture	Sulphur (parts per 100,000)	Sulphur (parts per 100,000)	Sodium Chloride
		%	%	%	%
236	surface.	8.75	0.08	0.42	0.20
237	20 cms.	9.61	0.05	0.21	0.08
238	30 cms.	9.31	0.02	0.38	0.03

The use of lime or limestone was recommended, or, if these were found too expensive, sand was suggested. Any one of these three materials would render the soil more open and porous and hence lighter to work and more easily drained.

The percentage of injurious salts in the drainage water from Kassassin was practically the same in 1903 as in 1902. The details are given in the following table:—

PARTS PER 100,000.

MONTH	1902					1903				
	Matter in Solution	Sodium Chloride	Sodium Sulphate	Sodium Carbonate	Sodium Bicarbonate	Matter in Solution	Sodium Chloride	Sodium Sulphate	Sodium Carbonate	Sodium Bicarbonate
January	—	—	—	—	—	119.2	53.96	33.73	nil	52.92
February	—	—	—	—	—	149.2	58.56	38.59	nil	57.12
March	116.8	45.71	25.82	nil	—	152.4	66.02	35.07	nil	67.20
April	125.6	48.05	32.64	nil	—	127.2	49.37	28.74	nil	65.52
May	120.0	50.39	35.98	trace	—	117.6	45.92	27.04	nil	63.84
June	131.2	59.77	40.79	trace	—	128.0	52.78	32.39	6.36	52.92
July	110.4	44.53	29.10	nil	—	121.2	46.40	28.13	nil	66.36
August	95.2	37.50	25.08	trace	—	96.8	34.80	21.43	nil	57.12
September	80.0	29.85	23.01	trace	—	81.2	31.32	17.96	nil	52.08
October	87.6	33.29	22.28	trace	—	86.2	32.48	21.37	nil	52.08
November... ..	98.0	36.74	26.43	trace	52.08	81.2	29.00	17.29	nil	52.08
December... ..	101.2	37.89	21.56	nil	61.32	87.8	38.28	16.32	nil	60.48
Mean	106.6	42.37	28.23	—	56.70	112.3	44.90	26.50	—	58.31

It has been a year of great pressure of work in the Department and Messrs. Humphreys and Craig, Chief Inspectors, and Mr. Hansard, in charge of the Drawing Office, have had much difficulty in keeping the out-turn up to the increased requirements; the Inspectors in charge of Survey Taftishes have all done very well and have improved both the quality of the work and the amount, though local interests often greatly increase their difficulties.

— — — — —

During the summer of 1902 instructions were received from the Ministry that in future the records of all Nile gauge readings, south of Aswan, should be kept by the Survey Department. Measures have been taken to systematise the taking of gauge reading as far as possible, and there has certainly been an improvement; counterfoil observation books have been provided and the readings are forwarded weekly, and on receipt, are printed and circulated.

The gauges which exist at present are:—

<i>Nile</i>	{	Wadi Halfa	masonry gauge	Records from 1891 4th May 1900 *
	{	Berber	temporary	
<i>Blue Nile</i>	{	Athara	temporary	
	{	Roseires	..	
	{	Sennar	..	
	{	Wad Medani	..	
		Khartoum	on masonry river wall †	
<i>White Nile</i>	{	Ducim	temporary iron plate gauge	
	{	Taufikia	inclined teak gauge	
<i>Sobat</i>	{	Nasser	inclined teak gauge	
	{	Doleib Hilla	.. ..
<i>Bahr-el-Jebel</i>	{	Ghaba Shambe	vertical iron plate gauge	
	{	Mongalla	inclined teak gauge	
	{	Gondokoro	.. ..

Most of these gauges have been moved from time to time, so it is desirable that the changes should be recorded.

Wadi Halfa.—A masonry gauge built in 1890 and not changed since its zero is at R.L.

Berber.—A temporary gauge.

Athara.—A temporary wooden gauge unsuitably placed.

Khashm-el-Girba.—A gauge cut in rock by Mr. C. E. Dupuis in April 1903.

Khartoum.—A masonry gauge on the river quay wall near the works Department. According to the levels of the Sudan Railways the zero of the gauge is at 1213 ft. = 369.71 metres (very approximately) above Suakin sea level.

* Also during the floods of 1881 and 1882.

† Also during the floods of 1869-1883.

It was temporarily moved in June 1903, during the building of the river wall, to a point not far off, but the level was carefully preserved and consequently no correction is required to the readings.

At Roseires is a temporary gauge which has been more than once disturbed. It is an iron vertical gauge placed in a sloping bank. It is 2 metres long and is movable as river rises and falls; there are two bench marks to control any movement, one reads 3.70 the other 7.05 metres.

Its zero is now inconveniently high and minus readings occur from the middle of March until June.

Sennar.—A similar gauge to that at Roseires, but without a bench mark.

Wad Medani.—A similar gauge to that at Roseires, its two bench marks read 4.00 and 10.00 metres.

At Dueim, 320 kilometres south of Khartoum, a temporary wooden gauge was erected in 1900. In April 1901 three lengths of a wrought-iron gauge were erected at 3 points on the sloping bank. During the autumn of 1902 one of these was knocked down and lost. It is proposed to build a masonry gauge at this point, but it has not yet been done.

At Taufikia 830 kilometres from Khartoum and just below the junction of the Sobat with the White Nile a wrought-iron gauge was fixed in April 1901, but in 1902 this gauge was moved to Fashoda where it was for some months in use.

In 18th April 1903 a new gauge was fixed. This was made of two 4-metre baulks of teak each of which were anchored back into the bank with teak trestles, so as to lie approximately flush with the bank and so be protected from boats, hippopotami, &c. The upper surface is divided metrically, a brass mark being placed at each 5 centimetres. When in place the angle of slope is measured and the reading on the scale is converted to the vertical by multiplying it by the sine of the angle of slope. At Taufikia a second sloping scale was erected above the first as the rise of the river was greater than could be recorded on one. The correction factors for these are 0.438 and 0.514.

A similar gauge was erected at the American Mission Station at Doleib Hilla at the end of April 1903, and in May Captain Wilson fixed a similar one at Nasser. In September 1903 a temporary wooden gauge was fixed at Ghaba Shambe which will be replaced by a wrought iron one. Correction factor for Doleib Hilla 0.590.

At Mongalla on the Bahr-el-Jebel a teak sloping gauge was fixed at the beginning of April 1903 and has been regularly observed ever since. Correction factor 0.701.

At Gondokoro gauge readings exist since 1900, but the gauges have been lost or moved on several occasions. A sloping teak gauge was fixed on the 9th April 1903 and since then this has been regularly in use. As there is no little confusion in consequence of the various changes, the following history of this gauge is given.

Observations were commenced here on 6th December 1900 after those which had been taken further up-stream, at Fort Berkeley from 1st September 1899 to 2nd December 1900 were discontinued. The gauge was a light wooden rod graduated in feet and inches. This may be called gauge A.

On 27th March 1901 a more substantial gauge of sheet iron screwed to a wooden upright which was strutted from the bank was fixed at the time of Sir W. E. Garstin's visit. * This may be called B and was divided into metres and centimetres.

On the 13th November 1902 this was knocked down in the night and lost, and another, C, was erected on 18th November 1902 which was graduated in feet and inches.

To avoid the uncertainty caused by such frequent changes of gauge, on 9th April 1903, a sloping bank of teak was fixed parallel to the slope of the bank and firmly anchored back into the bank, so as to be out of the way of boats and hippopotami. This bank is graduated metrically and has a mark at each 5 centimetres. It is fixed at a slope of 60° so that its readings require to be multiplied by 0.866 to reduce them to vertical metres.

These changes may be tabulated as follows:—

GAUGE.	IN USE		READING.
	from	to	
A.	6.12.00	27.3.01	Feet and inches.
B.	28.3.01	12.11.02	Metric.
C.	18.11.02	8.4.03	Feet and inches.
D.	8.4.03	to date.	Metric.

* See Blue Book Egypt No. 2, 1901.

Thus there has been a constant record, except from 13th to 18th November 1902. The correction of these different series of gauge readings with one another is therefore most important.

On the 9th April D gauge was erected and read 0^m48 or 1 ft. 7 in. while the C gauge which it replaced read 4 in., thus the readings of C gauge require an addition of 0^m38 to reduce them to those of D gauge.

A difficulty arises now in connecting B gauge with C in consequence of the interval of 5 days between the loss of B gauge and the erection of C gauge.

The recorded readings converted to metres are as follows :—

1902	metres
10 November	1.37
11 „	1.42
12 „	1.50
13 „	—
14 „	—
15 „	—
16 „	—
17 „	—
18 „	0.86
19 „	0.84
20 „	0.84

Thus to reduce the B gauge readings to the C gauge the correction will be 0^m64 *if there was no fall or rise in the river between 12th and the 18th of November.*

Mr. Westry, who was the observer, has stated that he believes the river was stationary between these dates, but no note was made at the time. On the 28th March 1901 B gauge was fixed and read 0^m30 when A gauge was reading 1 ft. 6½ in. thus the correction to correct its readings to those of B gauge is 0^m16.

These corrections are given in the following table :—

GAUGE.	CORRECTIONS TO REDUCE TO			
	A.	B.	C.	D.
A.	0	−0 ^m .16	−0 ^m .80	−0 ^m .42
B.	+0 ^m .16	0	−0 ^m .64	−0.26
C.	+0 ^m .80	+0 ^m .64	0	+0 ^m .38
D.	+0 ^m .42	+0 ^m .26	−0 ^m .38	0

There is no reason to believe, however, as stated above, that the river must have fallen in the interval between gauges B and C. The amount of the fall necessary to render the discharges which were taken in 1901-2-3 consistent, is 0^m287. Since the river is falling in general in November, it is probable that its level was not maintained constant between gauges B and C. Moreover observations made by the flood discharge party in 1903 at Mongalla, Lado and Gondokoro show that the difference in level between the 1902 and 1903 floods was about 0^m90, whereas the difference on the gauges is 1.24; thus additional correction of about $\pm 0^m30$ to gauge-readings on B and consequently A is thereby indicated.

H. G. LYONS,

Director General Survey Department.

REPORT ON THE TECHNICAL DEPARTMENT

1903

BY

MD. ANIS PASHA,

CHIEF OF TECHNICAL DEPARTMENT.

TECHNICAL DEPARTMENT

YEARLY REPORT, 1903

STEAM ENGINE SERVICE.

The work of the Steam Engine Service during the year 1903 was again satisfactory. The demands for Rokhsas were examined and either sanctioned or refused without any delay beyond what was necessarily occasioned by the ordinary procedure and routine of the Service, and the inspection was carried out without much of the former antipathy and evasions on the part of the owners, whether native or foreign.

Many of the owners have not only realised the necessity of keeping their plant in conformity with the conditions of safety laid down by the law, but have also recognized that it is to their benefit and interest to keep them in that state. Mr. Crawley, who has always tried to induce them to interest themselves in their machinery, reports some considerable progress in the general condition and upkeep of the engines and boilers, and a distinct improvement in the way they are now used and treated by the drivers, although as yet far from satisfactory.

The number of applications for Rokhsas for Industrial Engines received during the year 1903 was 359 as against 290 in the previous year. This number, together with 64 applications remaining for further consideration from 1902 and 35 received from the different Mudiriehs for permits to allow irrigation pumping engines to be also used for industrial purposes, makes a total of 458. Of these, 362 were granted and 96 remained under consideration at the end of the year.

233 engines out of the 362 granted Rokhsas were submitted to the regulation, examination and test and having proved satisfactory, were given permits to work.

This number with 1056 sanctioned to work up to the end of the year 1902, makes a total of 1289 industrial engines working in conformity with the law up to the end of December 1903.

The number of visits of inspection made by the staff of the Service was 750, 233 for the above mentioned newly licensed engines, and the rest, 517, for either examining the machinery or testing the boilers of older established engines.

Besides the above, many irrigation pumping engines were also visited, either on account of complaints received, or at the request of the Inspectors of Irrigation.

I mentioned in my last report that the Steam Engine Service was called upon by the Inspectors of Irrigation on several occasions to examine or test old pumping engines complained of as being dangerous or in very bad repair, and that some of these engines were found in such a dangerous condition that the Service was obliged to stop them administratively after obtaining the consent of the Irrigation Service. I also remarked that Art. 6 of the Decree empowers the Service to examine and inspect all irrigation engines, and to prescribe to them any conditions it may deem necessary for the public safety.

In 1903, these calls for examination and test have considerably increased, and many of the engines inspected were found in a very bad and uncared for state and had to be stopped, either for repairs, or as unfit for use. Also, as soon as it became known to the public that the Technical Service was also dealing with the irrigation engines, many complaints were made against them, and engineers had to be sent to almost every part of the country to examine into the subjects of these complaints and report upon them to the Service upon which the necessary actions with respect to public safety are taken.

The deplorable state in which many of these engines were found, and the inconvenience caused by this cumbersome system, suggested the expediency of taking immediate steps to bring them under the direct control of the Steam Engine Service, and to a certain extent subject them to the same regulations with respect to public safety as the engines in industrial establishments are now subjected to.

But as so much of the prosperity of the country depends upon these engines and no wholesale action can possibly be taken against them, any proposed change in their present state should necessarily be effected gradually and cautiously.

It was consequently arranged to deal first with the engines requiring new Rokhsas or old Rokhsas renewed and bring them at once under the control of the steam engine law.

The engines already established and duly licensed will have to be left to the care of the Service with the help of the irrigation officers to be dealt with in the way they have been during the last two years, and so get them improved bit by bit till in time all the dangerous ones disappear and the others come under proper control.

In dealing with the newly licensed engines, it has been arranged that from the beginning of 1904 all Rokhsas for portable as well as

for fixed irrigation engines must, after the consent of the Inspector General of Irrigation concerned, be issued from the Technical Service only and that even no temporary permit to work any engine shall be given without the intervention of the said Service.

Moreover, the Technical Service, by taking full advantage of Art. 6 of the steam engine law issued on the 5th November 1900 above mentioned, will insert in every Rokhsa issued or renewed the conditions of safety laid down by the said law, and deal with the engines, as far as public safety is concerned, in the same regular procedure as the engines in industrial establishment. Thus, no engine with a new Rokhsa or with an old Rokhsa renewed will, in future, be allowed to work before it is thoroughly examined and its boiler tested and pronounced in a safe working condition.

By this means, we shall not only be sure of the newly licensed engines, but also a stop will be put to the great abuse now practiced of buying old boilers which the Service had condemned as unfit for use in industrial establishments, such as mills, etc., and using them for irrigation purposes, simply because there has been no technical inspection of irrigation engines.

Also, as the Rokhsas will be registered in the books of the Service the owners will be directly under our control in matters of contravention and can easily be dealt with according to the law.

During the year the Service was more than once asked to examine and report on river steamers, but could not comply owing to the Decree of the 5th November 1900 having no provision for steam boats. A special project, therefore, is now being prepared by the Technical Service with the intention of its forming a part of a General Layha for river navigation which the Ministry of the Interior is desirous should be put into force.

The number of procès-verbaux of contravention drawn up against engine proprietors during the year was 49, of which 41 were submitted to the Native Courts and 8 to the Mixed Tribunals.

In the Native Courts 11 proprietors were sentenced to stop their engines, 2 were fined and one was acquitted. Of the remaining 27 cases, one was withdrawn by this Service and 26 were still in court at the end of the year.

In the Mixed Tribunals 6 proprietors were condemned to stop their engines, and 2 were still awaiting trial at the end of the year.

From the above it will be seen that the judgments in both Courts were on the whole very satisfactory. This is owing to the Layha being better understood and the cases better pleaded by the Parquet.

Three boiler explosions took place during the year, one at Dishna, another at Minia, and another at Corashia.

The explosion at Dishna was a very serious one, causing the loss of 4 lives and serious injury to 3 people.

This boiler was very old and its proprietor was warned of its bad state by the Service which ordered him not to use it until it was thoroughly examined and tested. He, however, took no heed of this order and worked it without the knowledge of the Service with this unfortunate result.

On examination of the boiler at the scene of the explosion the cause of the accident was found to be excessive corrosion from old age.

At Minia, the explosion was of the boiler of an agricultural locomotive 31 years old belonging to the Société des Sucreries. It occasioned the death of two persons and badly injured one.

Owing to all traces of evidence being removed from the scene of the explosion the exact cause could not very well be ascertained, but as it appeared that the loads on the safety valves were not altered to suit the great age of the boiler the explosion was undoubtedly due to over pressure.

At Corashia the exploded boiler was a Cornish one that supplied steam to an irrigation fixed engine. The explosion was due to shortness of water, and caused the death of the engine driver.

40 Rokhsas for irrigation fixed engines were given from this Service during the year; 29 for new stations and 13 in exchange for old Rokhsas. The fees received for these Rokhsas came to L.E. 348,500.

The total number at the end of 1902 was 816. Of these, 14 were cancelled and 803 remained. This number with the 40 new Rokhsas, make the total number of Rokhsas in hand at the end of the year 842. Their distribution among the different irrigation Circles is as follows:

	In hand to end of 1902	Cancelled in 1903	Given in 1903	In hand to end of 1903
1st Circle	226	6	13	233
2nd „	320	3	11	328
3rd „	105	—	1	106
4th „	130	2	7	135
5th „	24	—	—	24
Girga Directorate	8	1	2	9
Delta Barrage Directorate... ..	3	2	4	5
Assyut Barrage Directorate	—	—	2	2
	816	14	40	842

The staff of the Steam Engine Service is totally inadequate for the heavy and increasing duties it is now called upon to perform, and in spite of the continuous efforts of Mr. Crawley and his assistants, I feel that before inspections and tests can all be efficiently and expeditiously carried out, it is absolutely necessary that the staff should be increased.

Great praise is due to Mr. Crawley for the manner in which he and his small staff have carried out the work of this Service during the year with such satisfactory results.

QUARRIES SERVICE.

The total number of Rokhsas for quarries, in Cairo and its vicinity, at the end of the year 1902 was 613, of which 126 were given for life and 487 for a term of ten years.

During the year 1903 the Service cancelled 73 Rokhsas, 7 of the former and 66 of the latter class, while 43 new ones were granted. The total number in hand at the end of 1903 will thus be:—

Rokhsas for life	| 126—7 |	...	...	...	...	...	=119
Rokhsas for 10 years	| 487—66+43 |	...	...	...	...	...	=464
Total...	...	...	...	...	...	...	<u>583</u>

The fees received for the new Rokhsas amounted to L.E. 1195,590 Milliems.

The different localities of all the licensed quarries under the control of this Service, and the time of expiry of their Rokhsas are shown in the annexed table.

CENTRAL STORES

I.—ARTICLES PURCHASED OR MADE.

(A) *Instruments and camp equipments.*

		L.E.	M.		
Purchased from Europe	{ England	427	939		
	{ France.	120	432		
		<hr/>		548	371
Made by Govt. Services	{ War Office	277	659		
	{ Arsenal	53	817		
		<hr/>		331	476
Purchased in Egypt.....	{ from Govt. Services	66	539		
	{ from the market ...	123	901		
		<hr/>		190	440
				<hr/>	<hr/>
				1070	287

(B) *Furniture.*

Made by Govt. Services	{ Guizeh Water Service	21	117		
	{ War Office	3	905		
	{ Arsenal	82	195		
		<hr/>		107	217
Purchased in Egypt.....	{ from Govt. Services	108	700		
	{ from the market ...	139	020		
		<hr/>		247	720
				<hr/>	<hr/>
				354	937

II.—REPAIRS TO INSTRUMENTS.

Repairs made at the Arsenal	319	603
Total,	L.E.	<u>1744 827</u>

III.—ARTICLES ISSUED AGAINST PAYMENT.

To the Irrigation Department	163	160
„ Building and Tanzim... ..	93	094
„ Nile Steamer Service... ..	14	410
„ Daira Sanieh	7	320
„ Sudan Government	8	400
„ Sanitary Department	0	876
„ Messrs. Dupuis and Crawley	14	484
„ Merchants in Cairo	0	300
		<hr/>
		302 044

IV.—ORDERS GIVEN TO THE STORES.

For issue of articles.....	{ to Govt. Services	197	000		
	{ against payment.. ...	16	000		
		<hr/>		213	000
For receipt of articles..	{ returned	110	000		
	{ purchased	54	000		
		<hr/>		164	000

The value of the articles delivered from the Stores and charged to the Budget was L.E. 1563.229 distributed as follows :—

Irrigation Department	816	634
Building and Tanzim... ..	196	364
Technical Service	53	707
Administrative Service	290	940
Reservoirs Service	116	766
Survey Department	88	818
Total... ..	L.E.	<u>1563 229</u>

ARSENAL AND BOATS.

The work executed in the Arsenal workshops, and the materials delivered from its stores during the year 1903 amounted in value to L.E. 21327 as against L.E. 28357 the year before.

Most of this amount or 89.4% of it was charged to the different branches of this Ministry, the rest or 10.6% was charged to other Government Departments and private individuals, shown as follows:—

	1903	1902
	L.F.	L.E.
Value of work executed for P.W.D.	17021	22504
Cost of coals and engine room stores for steamers	2031	2748
Total for P.W.D. ...	<u>L.E. 19052</u>	<u>25252</u>
Value of work and materials for other Government Departments	2028	2966
Value of work and materials for private individuals	<u>247</u>	<u>139</u>
Grand Total	<u><u>21327</u></u>	<u><u>28357</u></u>

The distribution of the above amounts is shown as follows:—

SUM CHARGED TO THE DIFFERENT BRANCHES OF THE MINISTRY OF PUBLIC WORKS.

	1903	1902
	L.E.	L.E.
Irrigation Services	11188	15328
Reservoir Service	—	146
Building and Tanzim Department	638	671
Survey Department... ..	1252	1646
Administrative Service	51	370
Technical Service	346	
Repairs to steamers and maintenance of Arsenal plant... ..	<u>3546</u>	<u>4343</u>
Total	<u><u>L.E. 17021</u></u>	<u><u>22504</u></u>

Sum charged to other Government Departments:—

	1903	1902
	L.E.	L.E.
Ministry of Justice	10	325
„ „ Finance	49	245
„ „ Interior... ..	325	211
„ „ Public Instruction	169	111
„ „ War	45	—
Army of Occupation	11	55
Sanitary Department	360	928
Mudiriehs, Governorates and Town Councils ...	208	405
Khedivial Yachts	3	107
Model Workshops	848	560
Wakf Administration.	<u>—</u>	<u>19</u>
Total	<u><u>L.E. 2028</u></u>	<u><u>2966</u></u>

The charge against the Irrigation Circles was much less this year than the year before. It amounted, as shown before, to L.E. 11188 in 1903 as against L.E. 15328 in 1902 or less by about 27%.

The main items in this charge were for:—

459 tons of steel pipes costing L.E. 5840 as against 671 tons at L.E. 8232 the year before.

119 tons of cast iron grooves costing L.E. 1259 as against 163 tons at L.E. 1766.

1780 pieces of regulating timbers at L.E. 1104 as against 3680 pieces at L.E. 2720.

Also L.E. 1211 for galvanised iron pipes imported for 2nd Circle, L.E. 299 for building new hull for steam launch "Yemkin" belonging to 1st Circle and repairing a lock gate for Ismailia canal, L.E. 121 for making grid irons and some castings for Etsa pumps, and L.E. 1354 for miscellaneous work and stores.

The quantity of work executed for the Building and Tanzim Department is practically the same as last year. This work consisted of:—

	L.E.
Castings for Ghiseh and Ghesireh pumps	180
Tree guards and grids	213
Repairing carts	90
Making new carts	30
" wooden railings, etc.	45
Miscellaneous work	80
Total	<u><u>L.E. 638</u></u>

The Survey Department was supplied with angle iron triangulation marks for L.E. 766, and technical apparatus, office furniture and fittings, and sundry other work for L.E. 486.

The Administrative Service was charged L.E. 51 mainly for office furniture; and the Technical Service L.E. 346 for instruments and instrument repairs for the Central Stores.

The main items in the charge against the other Government Departments were for:—

	L.E.
Repairing steamers of the Ministry of the Interior	308
Making examination tables for the Ministry of Public Instruction	151
Making dust bins and carts for the Sanitary Department	335
" carts for Municipalities and Town Councils	118
Erecting machinery and doing other work for Model Workshops	777
Various other work and stores to the different Departments	<u>339</u>
Total	<u><u>L.E. 2028</u></u>

Very little was done to the Arsenal workshops this year.

The shop engines and some of the machine tools were repaired, the hand tools replenished, the portable engine and cranes in the yard overhauled and adjusted and some of the walls restored.

Of the floating plant, some of the rowing boats, barges and lighters, a house boat, and a landing stage were also repaired. The total cost of this amounted to L.E. 633 which was paid from the Arsenal profits.

Also, some spare articles and tools which cost L.E. 398 and paid for from the Budget were made in the shops and kept for the Arsenal in store.

The cost of materials bought for the workshops and steamers, exclusive of coals, amounted to L.E. 9802.

Of this amount, materials to the value of L.E. 7754 were taken from local merchants or imported from Europe through local agents, and L.E. 2048 ordered direct from Europe by the Service.

The total quantity of coals bought during the year amounted to 39050 kantars and cost L.E. 2838. Of this quantity, 26055 kantars costing L.E. 1520 were delivered direct to the Arsenal stores and 12995 kantars costing L.E. 1318 were taken from Cook's and the Daira Sania's and other coaling stations for the use of steamers when in commission.

The total amount spent on materials and coals during the year was thus L.E. 12640.

The quantity of stores issued to the workshops and steamers amounted in value to L.E. 13739, shown as follows:—

	L.E.
Value of materials used in workshops	11818
.. .. coals	778
.. .. deck stores for steamers	430
.. .. engine room stores for steamers.	212
.. .. coals for steamers	501
Total value of quantity issued	<u>L.E.13739</u>
Adding value of coals taken from coaling stations ... ..	.. 1318
Total value of materials, etc.	<u><u>L.E.15057</u></u>

The total cost of labour, which is nearly all native, amounted to L.E. 4538.

From the preceding statements it will be seen that most of the work executed in the Arsenal was for the Irrigation Circles and it mainly

consisted of the usual type of work such as sleepers, grooves, pipes, etc. The variation in the cost of the sleepers is very little; it depends on the price of wood which has been constant for the last two or three years. The quality of the work of preparing them does not call for any remark being every-day work well understood by the men.

The average cost of grooves has also remained unchanged. It is L.E. 9 per ton of ordinary grooves, and L.E. 10 per ton of grooves with cast strips requiring planing by machine.

Since the introduction of the hydraulic rivetting machines in the Arsenal the rate of cost of iron work has gradually been reduced. In speaking on this subject in my last report I said "the Arsenal has, in my opinion, reached the limit of economy of labour on this kind of work and any further reduction of the cost must be looked for from the prices of materials." This year steel plates were bought at the average price of L.E. 7.90 per ton and coals at L.E. 1.30 per ton as against L.E. 8 and L.E. 1.35 per ton respectively in 1902, and rate of cost of steel pipes came to L.E. 12.25 per ton as against L.E. 12.27 per ton, which is practically the same.

Also, the rate of labour per ton came to L.E. 1.38 as against L.E. 1.49. This slight reduction in the rate of labour is owing to a small hydraulic rivetter made at the Arsenal and used this year in rivetting small pipes down to 0^m75 diameter.

This small tool has not only afforded great facility in making the small pipes which were formerly made by hand under some difficulties, but also stopped the complaints we used to receive of this class of work.

In concluding my remarks on the workshops I should note the satisfactory state of the carpenters and joiners shop which is always kept busy and turns out excellent work.

Before high Nile every steamer was, as usual, thoroughly overhauled and repaired or furnished as required.

The total expenditure on the steamers during the year came to L.E. 6505.

Of this sum L.E. 2033 was spent on repairs, and deck fittings and stores, L.E. 2031 on coals and engine room stores, and L.E. 2441 on the crews. This is shown in detail in the following statement:—

STEAMERS.	Repairs.		Deck fittings and Stores.		Coals, Oils, etc.		Crew.		Total.	
	L.E.	M.	L.E.	M.	L.E.	M.	L.E.	M.	L.E.	M.
Nasratieh	271	275	82	500	242	906	375	313	971	994
Messir... ..	45	497	60	116	234	372	144	100	484	085
Tahita	136	466	40	086	117	875	319	753	614	180
Kahira	96	624	51	985	168	629	170	912	488	150
Bulak... ..	0	070	5	494	330	173	219	000	554	737
Refik	96	998	46	142	208	963	198	397	550	500
Dendera	74	386	28	274	399	496	264	492	766	648
Rekib... ..	91	717	47	267	91	272	185	763	416	019
Tawaf... ..	137	590	40	868	68	625	208	297	455	380
No. 1... ..	545	571	—	—	—	—	96	912	642	483
Moeris	30	938	17	399	54	048	63	772	166	157
No. 74... ..	20	850	3	955	11	355	54	675	90	835
No. 25... ..	0	400	5	743	75	785	88	645	170	573
Dredger No. 206	55	237	—	—	27	312	51	000	133	549
Total... ..	1,603	619	429	829	2030	811	2441	031	6505	290

Of this total expenditure the sum of L.E. 5794 was paid from the Budget, L.E. 37 from the Arsenal profits, and L.E. 674 was received for coals and engine room stores consumed by steamers when lent.

On examining the boats after their return at the end of the flood season the Nasratieh was found to be unfit for any further service. Her engines and boiler were found to be in a very serious condition and incapable of repair. She is now laid up until money is available to buy her a set of engines and boilers.

Her hull and her aft saloon fittings are in a very good state having been thoroughly repaired and done up only three years ago, and in my opinion, if she is fitted with light modern compound engines and the roof of her forward saloon and cabins, which is rather low, is raised she will be one of the best steamers in the Service.

The Tawaf was also found to require replating almost throughout and some of her frames renewing. She was therefore taken in hand at once and is now nearly finished.

The aft cabin on the stern has been removed and the deck made flush as was done on the Refik and Rekib, and instead of the deck being single it has been made double, not only to render the cabins much cooler by allowing a current of air to pass between the decks, but also to allow any of the deck boards to be replaced without destroying the ceiling of the cabins.

Her boiler which was rather small for her engines has been replaced by a new one of a larger size which was ordered from Europe for Tug No. 1. This boiler will be able to supply the engines with sufficient steam and the speed of the boat will probably be increased one or two kilometres per hour.

The cost of all this work with the price of the boiler was estimated at L.E. 700.

Tug No. 1 was laid up in 1902, on account of the dangerous state her 40 years old boiler was found to be in, and a new boiler was ordered for her from England. On the arrival of this boiler, however, it was decided to put it in the Tawaf and put in No. 1 a suitable new boiler that was found at the Barrage.

Owing to the want of sufficient steamers for inspection during flood it was decided to convert No. 1 into an inspection boat, and I hope in a short time she will be finished. The estimate for this work was about L.E. 250 (boiler not included).

We have now in course of construction a new tug boat to replace No. 1. This boat, which is built after the lines of the Barrage tug No. 30, will be propelled by an old engine taken some years ago out of the s.s. Jaffa and kept in the Arsenal stores, and the boiler lately taken out of the Tawaf will be utilised to supply this engine with steam. The total expenditure on this boat is estimated at L.E. 450.

In closing this section of my report I should like to add that Mr. Curtis has performed his duties in an efficient and satisfactory manner, and the work turned out under his supervision, speaks, as in previous years, very highly of him and also of the staff and men under his charge.

M. ANIS.

Chief of Technical Department.

Cairo, 14th April, 1904.

QUARRIES SERVICE.

YEARS OF EXPIRY OF ROKHSAS.

LOCALITY	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1919	Rokhsas for life.	Total.
<i>I.—Stone and ballast quarries.</i>													
Helwan	9	11	5	4	10	3	6	6	3	5	—	1	63
Ma'sara (el)	3	2	5	5	4	5	4	4	1	10	—	3	46
Tura	7	1	3	—	—	2	—	1	1	—	—	29	44
Hashmy (el)	—	—	—	2	—	—	—	—	—	—	—	4	6
Messan (el)	1	—	—	—	1	—	—	—	—	—	—	—	2
Eyout Moussa	3	1	2	—	3	2	—	—	—	—	—	11	22
Harit (el)	—	—	—	—	—	—	1	1	1	2	—	—	5
Emara (el)	—	7	8	7	6	3	4	1	1	—	—	6	43
Motabbak (el)	1	—	—	—	—	1	—	—	—	—	—	2	4
Fabhta (el)	1	1	1	—	—	—	—	—	—	—	—	—	3
Bassatin (el)	—	2	—	—	1	—	2	—	—	—	—	—	5
Atat el Naba	9	3	—	5	5	2	—	6	3	3	—	4	40
Batu el Bakara	4	—	3	3	3	3	5	2	2	4	—	10	39
Em el Sira	1	2	—	5	2	3	—	—	—	—	—	6	19
Abu el Seoud	1	1	—	1	—	—	—	—	2	—	—	8	13
Zawiet Nasra	1	—	2	3	8	10	2	7	2	3	—	8	49
Abiad (el)	1	—	—	6	5	—	—	4	—	2	—	8	29 ¹
Ma'dassa (el)	2	—	3	1	8	—	2	2	2	—	—	10 ¹	30 ¹
Dewelka	1	—	1	3	1	3	4	4	—	—	—	4	21
Ahmar (el)	—	4	18	10	4	2	3	—	1	2	—	3	47
Ablassieh (el)	—	—	—	—	—	—	—	1	—	1	—	—	2
Khashab (el)	—	—	—	—	—	—	—	—	—	—	—	1	1
Guzlani (el)	—	—	—	—	—	—	—	—	—	2	—	—	2
Raha (el)	—	—	—	—	—	—	—	—	—	1	—	—	1
<i>II.—Pebble, stone and sand quarries.</i>													
Babel-Nasr	—	—	—	—	—	—	—	—	—	—	—	—	—
Bassatin (el)	—	—	—	—	—	—	—	1	—	—	—	—	1
Ablassieh	4	2	1	1	—	9	8	6	6	5	—	—	45
<i>III.—Gathering of gypsum.</i>													
Fr. Helwan to Kayed Bey, 3 yrs.	2	—	—	—	—	—	—	—	—	—	—	—	2
<i>IV.—Extraction of clay.</i>													
Ma'sara (el)	—	—	—	—	—	—	—	—	—	—	1	—	1
Total	54	37	52	59	61	48	41	46	25	40	1	119	583

RAPPORT DU SERVICE DES ANTIQUITÉS

POUR L'EXERCICE 1903

PAR

G. MASPERO

DIRECTEUR GÉNÉRAL

RAPPORT DU SERVICE DES ANTIQUITÉS

Pour l'Année 1903.

I. — SERVICE ADMINISTRATIF.

L'augmentation totale de notre budget régulier a été, pour l'exercice 1903, de L. E. 784; elle a porté pour L. E. 184 sur le personnel classé, et pour L. E. 600 sur le personnel non classé. Elle nous a permis d'améliorer le sort de quelques-uns de nos petits employés et de perfectionner la marche des affaires sur plusieurs points; toutefois nous ne sommes pas encore organisés aussi complètement qu'il serait nécessaire et nous serons obligés de demander à l'État quelques légers sacrifices de plus, afin d'assurer partout le fonctionnement exact du Service.

Inspection du Directeur général. — Elle a été retardée par suite d'un accident survenu au remorqueur n° 1, que le Ministère met d'ordinaire à ma disposition. J'ai dû louer à la Compagnie Cook un de ses remorqueurs, et bien qu'elle eût consenti gracieusement à baisser ses tarifs, il m'a fallu changer mon programme: je suis remonté à la vapeur jusqu'à Assouan, sans m'arrêter nulle part, puis, renvoyant le remorqueur, je suis redescendu vers le Caire à la rame et à la voile, si bien que l'inspection de cette année n'a pas coûté plus cher que celles des années précédentes. Elle a duré deux mois, du 3 janvier au 8 mars, et, malgré les lenteurs de la navigation, elle a donné des résultats satisfaisants. Entre Philæ et Edfou, j'ai pu visiter les carrières d'El-Khammakah, les ruines voisines du village d'El-Hagar, et le petit temple romain de Resrâs, que j'ai retrouvés tels que je les avais connus autrefois. Par contre, les restes de la ville byzantine et arabe de Bouéib ont été fort endommagés lors de la construction du chemin de fer d'Assouan: la partie basse de la ville a été démolie par les ouvriers, y compris une moitié de la basilique, et, seule, la ville haute demeure à peu près intacte avec son donjon et ses remparts. La grotte des Crocodiles, près de Maabdeh, a été sacagée sans pitié après 1886: les momies ont été mises en pièces, et des incendies, allumés par l'imprudence des chercheurs de papyrus, ont détruit le contenu de galeries entières. La plupart des autres localités situées entre Siout et Minieh, Cosséir el-Amarna, Hadji-Kandil, Berchéh, Cheikh-Abadéh, ont moins souffert; toutefois, les ruines de la

ville romaine située au Kom el-Ahmar, près de Zaouïet el-Amonat, ont reçu dans ces derniers temps la visite des marchands de Mellaoui. L'inspecteur du Service, Sobhi Effendi Arif, prévenu en temps utile, a saisi quelques masques en plâtre d'un beau style et d'une conservation excellente, mais d'autres objets ont échappé à ses recherches et sont encore sur le marché occulte des antiquités.

L'état des grands édifices ne s'est pas modifié sensiblement depuis l'an dernier. J'ai en pourtant le regret de constater, lors de mon passage à Thèbes, que deux des colonnes encore debout dans la région septentrionale de la Salle Hypostyle menaçaient de s'écrouler, ainsi que les architraves brisées qu'elles soutenaient : ordre a été donné aussitôt à M. Legrain de tout préparer pour les démonter et pour en refaire les fondations pendant l'hiver de 1903-1904. J'ai reconnu également que le petit temple de Dêir el-Médinéh exigeait une restauration sérieuse : il faudra déposer la porte de l'enceinte, dont les fondations ont cédé, et probablement reprendre l'une après l'autre toutes les colonnes de la cour et du pronaos. Le temple de Gournah, lui aussi, semble être parvenu à terme de résistance, et bien des touristes ne s'aventureraient pas dans les salles s'ils soupçonnaient la condition précaire de plusieurs des colonnes et des murs. M. Barsanti, que j'ai chargé de l'examiner à fond, a conclu comme moi à la nécessité d'y opérer des travaux considérables dans le plus bref délai. Le manque d'argent nous a arrêtés au cours de cette année, mais, aussitôt que la consolidation de l'enceinte d'Edfou sera terminée, M. Barsanti ira commencer celle du temple de Gournah. Je crains que ce ne puisse pas être avant 1905 au plus tôt.

Travaux des inspecteurs en chef. — J'ai montré déjà combien il était nécessaire aux inspecteurs en chef d'avoir auprès d'eux quelques employés chargés de leur comptabilité et de leur correspondance tant avec l'administration centrale qu'avec leurs inspecteurs locaux et avec les agents des autres administrations égyptiennes. M. Quibell, qui réside au Caire, a pu utiliser le personnel du Musée pour les affaires de son inspectorat, mais M. Carter n'a pas la même ressource, et, cette année, j'ai dû continuer de lui adjoindre à titre provisoire deux secrétaires, dont l'un, Tewfik Effendi Boulos, est payé à raison de L. E. 60 par an sur les fonds de touristes, tandis que l'autre, Chebatah Ayoub, touche un salaire de L. E. 36 sur le chapitre des indemnités. Notre budget ne nous permet pas de faire davantage, mais le moment approche où il faudra doter l'Inspectorat du Saïd d'un personnel plus nombreux et mieux rétribué : prenant en considération le nombre toujours croissant des affaires, j'estime que ce ne serait pas trop de deux bons employés à

demeure, un secrétaire-interprète, qui suivrait l'inspecteur dans ses tournées, et un comptable, tous les deux inscrits dans le cadre.

1° *Inspectorat du Sud*. — Jusqu'à présent, l'Inspecteur du Sud avait résidé sur la rive gauche du Nil, dans la maison bâtie par le Service il y a une douzaine d'années lors du déblaiement de Médinet-Habou : l'éloignement du site et son isolement m'ont décidé à transporter le siège de l'administration sur l'autre rive du Nil. Un emplacement nous a été concédé par le Ministère des Finances, à petite distance au nord de Louxor, entre la route de Karnak et le fleuve, assez vaste pour contenir la maison de l'Inspecteur, les bureaux de l'Inspectorat et un magasin d'antiquités. La construction a été commencée en octobre dernier, sur des plans dressés par M. Baraize et approuvés par la Direction des Bâtiments civils : par décision du Comité d'archéologie, la dépense sera imputée sur le fond des touristes et répartie entre plusieurs années. D'octobre à fin décembre M. Baraize a construit les bureaux et l'écurie, le tout représentant une somme d'environ L. E. 450 ; les travaux de la maison d'habitation ne commenceront qu'au mois d'avril 1904, lorsque nous saurons à peu près quel a été le rendement des cartes de touristes.

La lumière électrique a fonctionné pendant tout l'hiver dans la Vallée des Rois, sans accident ni à-coups : nous n'avons pas été obligés de recourir une seule fois aux lanternes préparées dans chaque tombeau, en vue d'une extinction subite des lampes. La machine a été démontée au printemps, puis revue pièce à pièce, et elle n'a été remise en marche que dans les premiers jours d'octobre, lors du retour des touristes. L'expérience de cette année nous a révélé, comme de juste, quelques légers défauts de l'installation : nous avons reconnu, par exemple, qu'il y avait avantage à conserver toujours sous la main une provision d'eau plus forte, et nous avons ajouté deux réservoirs nouveaux aux deux que nous avions jugés suffisants d'abord. Il nous a fallu aussi modifier un peu la composition de notre personnel d'électriciens et engager de ce chef une dépense un peu plus forte ; mais, d'autre part, les frais de production et d'entretien sont montés beaucoup moins haut que nous ne l'avions pensé, ce qui nous a permis d'opérer cette modification sans dépasser, et même sans atteindre, nos prévisions. Le résultat a donc été heureux en tout sens, et il m'a encouragé à user du même mode d'éclairage dans d'autres localités. En attendant que nous l'appliquions au Sérapéum et aux tombeaux de Sakkarah, j'ai ouvert des pourparlers avec la maison Cook pour l'installation d'un réseau à Ibsamboul, et j'ai tout lieu de croire que l'année 1904 ne s'écoulera pas sans que le spéos de Ramsès II soit éclairé à l'électricité.

Le parc à baudets construit dans la Vallée des Rois ayant été d'une véritable utilité pour les âniers et pour leurs bêtes, il m'a paru bon d'en établir de pareils dans tous les endroits qui sont visités par les touristes en bandes. Nous en avons installé déjà plusieurs dans les localités de la rive gauche, à Dér el-Bahari, au Ramesséum, à Médinet-Habou : la maçonnerie en est achevée, et ils seront convert dans le courant de l'an prochain. Nous en ferons autant à Karnak, dès que le déblaiement sera avancé suffisamment.

La surveillance des monuments a été aussi pénible que les années précédentes : l'attaque dirigée en 1901 sur le tombeau d'Aménôthès II est demeurée impunie, ainsi que le vol d'une quantité de pièces d'or découvertes à Karnak. Les procès intentés ou soutenus par le Service contre les particuliers qui usurpent les terres antiques appartenant à l'État sont de même restés stationnaires : le plus important de tous, celui que nous avons avec Khalafallah bey au sujet de terrains à *schakh* de Haou, est toujours pendant devant le tribunal de Kénéli, bien que les expertises aient jusqu'à présent tourné à notre avantage. Enfin, dans certains cas, à Erment, par exemple, où les tribunaux avaient décidé en notre faveur, nous n'avons pas encore obtenu l'exécution du jugement.

Les travaux de réfection et de fouilles entrepris par M. Carter ont marché régulièrement. A Thèbes, le déblaiement du Ramesséum a continué avec le concours de M. Baraize ; une partie des édifices et des voutes en briques qui entourent le temple a été déblayée, et les décombres ont été amoncelés régulièrement le long du fossé d'enceinte pour protéger l'aire mise au jour. A Médinet-Habou, la prise du *schakh* a été dirigée de manière à dégager le mur antique, dont nous comptons utiliser les restes afin de clore le téménos du temple. En décembre 1903, une porte en grès y a été découverte par les fellahs, sur laquelle les scènes et les inscriptions n'étaient ni sculptées, ni peintes, mais constituées par des combinaisons d'émaux incrustés dans la pierre : une partie des pièces d'émail a été détournée par les preneurs de *schakh*, mais nous avons pu en racheter la plus grande partie, et j'espère rétablir le monument presque en entier au Musée du Caire. D'autre part, les fouilles commencées par M. Carter en 1902, à la Vallée des Rois, ont amené, pendant les derniers jours de janvier 1903, la découverte du tombeau de Thoutmôsis IV. Le mobilier funéraire avait été mis en pièces par les voleurs antiques, et les débris en gisaient épars sur le sol, mais les peintures des chambres et le sarcophage sont intacts. Les débris, recueillis et classés par MM. Carter et Newberry, sont aujourd'hui au Musée, à l'exception d'un petit nombre de pièces dont le

Service a fait hommage à M. Davis. Le tombeau de Thoutmôsis IV vidé, M. Carter a transporté les ouvriers dans un endroit voisin, où certaines indications nous engageaient à chercher le tombeau de la fameuse reine Hatshepsoutou. Les fouilles, menées cette fois encore aux frais de M. Davis, sont plus pénibles que nous ne nous y attendions. Le couloir, d'une pente très raide, a été vidé sur une longueur d'environ 180 mètres, sans que nous soyons encore parvenus à la chambre funéraire, et la chaleur y est si suffocante que nous devons envoyer sans relâche de l'air frais aux ouvriers au moyen de la pompe achetée naguère par M. de Morgan : nous étions descendus sous le temple de Dêir el-Bahari dans les derniers jours de décembre, sans que nul indice nous montrât que nous approchions de la fin, mais la dureté et la composition des remblais prouvent qu'ils n'ont pas été remaniés depuis une époque fort ancienne. Il est évident que l'architecte pharaonique a voulu placer la chambre funéraire derrière la stèle qui décore le fond de la chapelle du sacrifice, dans la partie méridionale du temple de Dêir el-Bahari, et c'est derrière cette chapelle, ou à peu-près, que nous nous attendons à trouver le sarcophage de la reine au cours de l'année 1904. En inspectant le même quartier de la Vallée, il m'a paru reconnaître deux points où se cachent des tombes encore inconnues, peut-être celles de Thoutmôsis II et de Hrihorou ; M. Carter y transportera ses chantiers, sitôt que la fouille actuelle sera terminée.

2^e *Inspectorat du Nord*. — Comme d'ordinaire, M. Quibell a eu plus d'affaires contentieuses à régler que de travaux scientifiques à exécuter. L'exploitation à outrance des *tells* du Delta par les preneurs de *schakh* amène chaque année la découverte de menus objets, de monnaies, de statues, que nos gardiens saisissent rarement, mais dont la saisie, lorsqu'elle peut avoir lieu, entraîne presque toujours un procès ; de plus, les parties de *tells* épuisées sont usurpées par les propriétaires voisins, à mesure qu'elles descendent à peu près au niveau du terrain environnant. M. Quibell a défendu de son mieux les droits du Service, qui sont ceux de l'État Égyptien, et cette tâche ingrate a consumé le meilleur de son temps. Il a continué la consolidation du temple d'Abydos, et il a achevé la fouille commencée par M. Dove Covington dans le champ des Pyramides de Gizéh : il sera question plus loin de cette dernière affaire.

Inspecteurs indigènes, réis et ghazirs. — J'avais demandé que les salaires des inspecteurs indigènes fussent relevés ; le Ministère des Finances a bien voulu me donner satisfaction partielle sur ce point. Grâce à la transformation d'un poste d'inspecteur de troisième classe en

un poste d'inspecteur de première, nous avons pu récompenser l'un de nos meilleurs officiers, Aly Effendi Habib, du zèle et de l'activité qu'il déploie depuis vingt-cinq ans pour la cause des Antiquités. L'inspecteur d'Assouan et d'Edfon, Mahmoud Effendi Mohammed, a été promu à la seconde classe, et nous avons accordé au nouvel inspecteur de Gournah, Moursi Effendi Halim, un traitement d'entrée plus élevé que celui qui est alloué d'ordinaire aux inspecteurs nouveaux. Dans le Delta, la mort de M. Botti nous a obligés à réinnir provisoirement le petit inspectorat d'Alexandrie à l'inspectorat de Gharbiéh. Dans l'Égypte Moyenne, Mohammed Effendi Chabân et Sobhi Effendi Arif ont permuté, le premier passant au Fayoum, le second à Miniéh-Assiout. L'exploration systématique du Fayoum par les savants européens, venant après l'exploitation dévastatrice des fouilleurs illicites, y a épuisé la plupart des anciens sites, et la vente ou la mise en valeur des terrains du Gouvernement a diminué considérablement les espaces à surveiller : le Fayoum convenait donc à un inspecteur fatigué, tel que Mohammed Effendi Chabân. Au contraire, les deux moudiriéhs de Siout et de Miniéh ont vu se multiplier depuis quelques années les champs de fouilles, et quelques-unes de leurs villes, Mellaoui, Siout, Gaou, sont devenues des centres importants de recel et de trafic clandestin. Le transfert de Sobhi Effendi dans cette région menacée a produit aussitôt des effets heureux : il ne faut pas nous dissimuler pourtant que la lutte sera longue, et que des années probablement s'écouleront avant que nous ayons eu raison de ces marchands, auxquels les lois actuelles assurent presque l'impunité.

La situation et le nombre des nos ghatirs et de nos réis ne changent pas sensiblement. J'ai pu porter à L. E. 1 par mois tous ceux d'entre eux qui ne touchaient pas cette somme, mais l'ensemble des salaires demeure insuffisant, si l'on considère le travail ardu que nous exigeons de ces gens et les responsabilités qu'ils encourent. Le tableau suivant en montrera le nombre et la répartition sur le territoire égyptien, ainsi que la quotité de leur solde et les fonds sur lesquels elle est imputée :

INSPECTEURS	NOMBRE.	Sous-ch. 1 art. 2 Personnel Hors cadre		Sous-ch. 1 art. 1 Fouilles.		Fonds des Touristes.	
		L. L.	M.	L. L.		L. L.	M.
<i>Inspectorat du Nord :</i>							
Menoutieh-Galioubieh	2	12		12		—	
Charkieh-Dahkalieh	10	96		12		12	
Gharbieh-Behera	5	36		24		—	
Fayoum-Beni-Souef	21	195		72		—	
Minieh-Siout	32	108		36		258	
Girgeh	13	36		24		105	
<i>Inspectorat du Sud :</i>							
Denderah	12	24		12		110	400
Louxor	16	12		—		186	
Gournah	34	12		144		272	400
Edfou-Assouan	25	108		—		180	
<i>Rélevant du Musée directement :</i>							
Gizeh	7	36		—		72	
Mit-Rahineh	7	43	200	—		66	
Sakkarah	36	223	800	—		349	200
Total.. ..	220	942		336		1611	

Les provinces de Minieh et de Siout ont bénéficié de la meilleure partie de l'augmentation : elles ont reçu neuf ghafirs nouveaux et je prévois qu'elles en exigeront d'autres. Il nous faudra instituer une cinquantaine de postes environ pour compléter la surveillance de l'Égypte entière. J'ai dû ajourner cette création, faute d'argent ; en revanche, j'ai nommé dans chaque circonscription un chef-ghafir, dont les appointements sont un peu plus élevés que ceux des ghafirs ordinaires. Depuis que, sous l'impulsion des inspecteurs en chef, les inspecteurs locaux ont manifesté une activité toujours plus grande dans l'exercice de leurs fonctions, j'ai reconnu qu'ils devaient avoir toujours sous la main un homme de confiance, qu'ils pussent mander d'urgence dans les localités où ils étaient empêchés de se rendre eux-mêmes, ou qui les accompagnât dans leurs rondes et leur prêtât main forte au besoin, lorsqu'ils seraient obligés d'arrêter quelque fouilleur illégitime. J'ai donc placé d'abord des chefs-ghafirs dans deux inspectorats, celui du Fayoum et celui de Siout, pendant le cours des deux années dernières : les résultats obtenus m'ont

engagé à généraliser l'institution, et, depuis 1903, tous les inspecteurs ont un chef-ghafir attaché à leur personne.

Loi sur les Antiquités. — Le projet de loi qui avait été établi d'accord commun entre le Service, le Comité d'Archéologie et Mr. de Rocca-serra, a été de la part du Comité de Législation l'objet d'une révision minutieuse, à la suite de laquelle une troisième rédaction en a été donnée par les soins de M. Brumyatte. Toutefois, avant de le présenter à l'approbation de S.A. le Khédive et du Corps Législatif, le Comité de Législation insista pour qu'il fût soumis aux puissances, en vue d'une application immédiate aux étrangers qui résident en Égypte, bien que, dans l'origine, il dût toucher les seuls indigènes. Une tentative dans cette direction, faite officieusement aux mois d'août et de septembre, aboutit, comme on devait s'y attendre, à une fin de non-recevoir; et les choses en sont au point même où elles en étaient avant la démarche. Nous attendons que les autorités compétentes se soient décidées soit à promulguer le dernier projet sous une forme plus ou moins modifiée, en l'appliquant aux seuls indigènes, comme je le proposais, soit à en remettre la promulgation à des temps meilleurs, et à laisser le Service se débattre péniblement contre les voleurs et contre les destructeurs des monuments.

II. — LES FOUILLES ET LA RÉFECTION DES MONUMENTS

Comme d'habitude, je me bornerai à indiquer sommairement les localités explorées par les savants étrangers et les résultats principaux qu'ils y ont obtenus. Un accident mortel a jeté un voile de tristesse sur la fin de leur campagne. Le lundi 6 avril, M. Gombert, pensionnaire de l'Institut français d'Archéologie, qui dirigeait les fouilles de Tonnah, voulut explorer la colline à laquelle la stèle de Khômmiatonou est adossée. L'enquête menée par notre inspecteur de Miniéh, Sobhi effendi Arif, prouva qu'il s'était aventuré, seul et sans aide, sur l'un des sentiers qui courent en corniche le long de l'escarpement qui domine la plaine en cet endroit. Soudain, entre 11 heures et midi, ses ouvriers le virent perdre pied et tomber d'une hauteur de 15 ou 16 mètres : la roche avait cédé sous son poids, et il s'était fracassé les deux jambes sur un seuil pierreux qui émergeait à demi du sable. Le gardien du Service courut à Mellaoui chercher du secours, mais six heures s'écoulèrent avant que le blessé pût recevoir la visite du médecin attaché au Markaz, Mohamed Effendi Anouar. Il fut transporté à Mellaoui après les premiers soins, et là il fut pansé aussi complètement que son état le comportait par le Dr. Askren, de la Mission Américaine, que les autorités locales avaient mandé sur-

le-champ. Le Directeur de l'Institut, M. Chassinat, prévenu par une dépêche, se rendit sur les lieux avec M. Lacan, et tous deux, avec le concours dévoué du Dr Askren, l'emmènèrent au Caire dans la nuit du 7 au 8. Reçu à l'hôpital français, il y mourut le dimanche 12 avril, jour de Pâques, à 4 heures et demie de l'après-midi. La perte de sang au moment de la chute avait été si grande et l'ébranlement nerveux si violent que la sensibilité en avait été considérablement réduite; à part quelques intervalles de crise aiguë pendant lesquels les douleurs furent intolérables, il souffrit médiocrement, et il ne soupçonna jamais l'état désespéré dans lequel il s'était trouvé dès l'instant qu'on le releva. M. Gombert était un élève de l'École Centrale des Arts et Métiers de Paris et un architecte d'avenir, qu'un goût très-vif pour l'archéologie avait amené en Égypte. Il avait travaillé aux fouilles françaises d'Abou-Roache, de Baouït et de Tonnali. Sa troisième année de séjour finissait et il allait rentrer en France, lorsque la mort l'a frappé traitreusement. Tous les savants présents en Égypte, Allemands, Anglais, Italiens, ont voulu s'associer, comme le Service des Antiquités, au deuil de l'Institut français, et présenter l'expression de leur commisération au père qui arrivait trop tard pour voir une dernière fois son fils vivant.

L'Institut français avait ouvert successivement trois chantiers. Celui de Tonnali était en pleine activité lorsque la mort de M. Gombert le désorganisa; le récit de la fouille sera publié par les soins de M. Chassinat. A Baouït, MM. Chassinat et Palanque avaient continué pendant deux mois les travaux inaugurés par M. Clédat, l'année précédente, parmi les ruines d'un monastère copte. Ils les interrompirent de nouveau pendant les derniers jours de février, et ils s'établirent dans la nécropole de Siout où, à la suite d'un accord intervenu avec un colonel en retraite de l'armée égyptienne, M. Chassinat avait obtenu l'indication de plusieurs sites vierges. Ils y étudièrent plusieurs tombeaux intacts des X^e et XI^e dynasties, dont M. Palanque a dressé minutieusement l'inventaire. Le Service a gagné pour sa part deux statues en bois d'un style fruste, mais de belle conservation, et toute une série de cercueils et d'objets funéraires qui complètent ses séries. Il a eu la désagréable surprise de se trouver impliqué, ainsi que M. Chassinat, dans un procès que plusieurs des commanditaires du colonel avaient intenté à celui-ci au moment du partage; mais ce n'était là qu'une chicane, et il a été mis promptement hors de cause par le tribunal mixte du Caire.

L'antique Antinoë a fourni à M. Gayet son contingent habituel de cadavres desséchés de basse époque romaine, et d'objets de toilette, de culte ou de ménage, parmi lesquels il a cru reconnaître un outillage de sorcière. M. Jouguet et son collaborateur Gustave Lefebvre, envoyés par

le Ministre de l'Instruction Publique de France et par l'École française d'Athènes, après avoir achevé l'exploration de Médinet en-Nahas et de Médinet Mahdi au Fayoum, ont poussé une pointe sur la grotte des Crocodiles à Maabdéh, puis, d'après mon conseil, ils se sont arrêtés à Tehnéh, où personne n'avait travaillé sérieusement. Ils n'ont pas abordé la butte où se cachent les restes superposés de la ville ancienne; ils ont opéré dans les necropoles gréco-romaines, et ils en ont retiré des monuments fort originaux, entre autres des cercueils et des momies en miniature à masque d'épervier et à décor en cire colorée. Plus de cent cinquante stèles funéraires en grec et en copte ont été retenues par le Service, et sont allées enrichir le Musée d'Alexandrie.

Les missionnaires allemands ont poursuivi leurs explorations sur leurs sites accoutumés. M. Borchardt a persévéré autour des pyramides d'Abou-ir, et M. Rubensohn, après avoir hésité quelque temps, s'est fixé sur les *tells* d'Achmounéin, non sans succès, partie aux frais de la Société Orientale, partie pour le compte de diverses Universités. Entre temps, le gouvernement allemand a sollicité par voie diplomatique le prêt, vers Médinet-Habou, d'un terrain où bâtir une maison à l'usage des savants qui désireraient étudier les hypogées thébains; c'est une conception pareille à celle que le gouvernement français avait eue dès 1883, lorsqu'il construisit sa maison à Louxor, entre le temple et l'hôtel Pagnon. Le terrain a été délimité en janvier 1903, d'accord commun entre M. Borchardt, M. Carter et moi, puis il a été remis aux représentants de l'Allemagne, sous condition pour ceux-ci de l'employer toujours dans un but purement scientifique, et de n'y installer ni hôtel, ni établissement commercial ou industriel; il ne pourra être ni loué, ni transféré, ni aliéné d'aucune manière, et, le jour où l'Allemagne renoncerait à l'occuper, il reviendrait de droit au gouvernement égyptien avec les constructions, les plantations et tous les aménagements qui y auraient été faits.

Vers le même temps, la difficulté de défendre les cimetières de Guizéh contre les entreprises des bédouins a décidé le Comité d'archéologie à en concéder l'exploitation aux particuliers qui se présenteraient. M. Covington avait travaillé déjà en 1902 au Sud du Sphinx, et il avait mis au jour un mastaba d'époque archaïque. Cette découverte, dont les personnes peu au courant des travaux de Mariette, s'étaient exagéré l'importance, avait soulevé une émotion assez vive, qui se traduisit, en janvier 1902, par des protestations contre l'attribution du site à d'autres qu'à des professionnels de l'égyptologie; d'accord avec le Contentieux du Ministère des Travaux Publics, j'ai maintenu les droits de M. Covington jusqu'au jour où, l'argent lui manquant, il y renonça de lui-même. Je pris alors la suite des travaux, et je déléguai M. Quibell à les achever. Ils ne don-

nièrent, comme nous avons lieu de le penser d'après l'expérience de Mariette en 1859, 1860 et 1861, que des résultats à peu près nuls: depuis lors, la concession de M. Covington est demeurée virtuellement vacante. Le reste du terrain qui avoisine les pyramides a été divisé en trois lots entre MM. Steindorff, Reissner et Schiaparelli, avec cette réserve toutefois que, vu l'importance des lieux, si d'autres requérants se présentaient, une part leur serait attribuée dans les endroits où les premiers occupants n'auraient pas encore établi leurs chantiers. M. Reissner s'est borné à prendre possession de son domaine qu'il compte explorer à fond et de manière exclusivement scientifique: MM. Steindorff et Schiaparelli ont procédé à l'exploitation du leur, et ils y ont déblayé quelques mastabas assez bien conservés de la IV^e dynastie.

M. Steindorff agissait pour le bénéfice de l'Université de Leipzig, mais M. Schiaparelli avait une mission officielle du gouvernement italien. L'Italie s'est décidée en effet à suivre l'exemple que lui donnaient l'Allemagne, l'Angleterre et la France, et elle s'est associée à l'exploration archéologique de l'Égypte. M. Schiaparelli a demandé et obtenu, outre le champ de Guizéh, quatre localités importantes: la Vallée des Reines à Thèbes, le Gebel-Tarif dans toute sa longueur, les ruines d'Achnounéin, et l'emplacement de l'antique Héliopolis. Il n'a pas touché cette année au Gebel-Tarif et il a effleuré à peine Héliopolis. Il a découvert et vidé complètement, avec l'assistance de M. Ballerini, plusieurs tombeaux dans la Vallée des Reines: le plus intéressant à tous les points de vue est celui d'un certain prince Khamoisit, fils de Ramsès III. M. Breccia a travaillé quelques semaines à Achnounéin, et il y a recueilli des fragments de papyrus assez nombreux: toutefois des difficultés, survenues entre lui et M. Rubensolin au sujet de leurs concessions respectives, ne lui ont pas permis de donner à ses opérations toute l'étendue qu'elles comportaient.

M. Reissner n'a pas encore ouvert d'ateliers à Gébéléin; de même que les années précédentes, il a concentré ses efforts sur les cimetières archaïques de Thinis, à Naga ed-Déir. Il y a appliqué, en collaboration avec M. Lythgoe, la même rigueur de méthode dont il avait donné l'exemple dans ses campagnes antérieures, et il en a été récompensé par le même succès.

M. Garstang s'est risqué sur les pentes inférieures de Béli-Hassan, que j'avais jusqu'alors recommandé en vain à l'attention des égyptologues, et il y a ouvert, outre deux hypogées de l'âge Memphite, beaucoup de tombeaux encore intacts du premier Empire Thébain, ceux des princes secondaires du nome de la Gazelle ou des officiers attachés à la personne des grands seigneurs enterrés à l'étage supérieur: sa campagne a été

presque aussi fructueuse, pour lui et pour notre musée, que celle de M. Chassinat, à Siout.

M. Flinders Petrie, qui agit cette fois encore pour le compte de l'*Egypt Exploration Fund* et de l'*Egypt Research Account*, a dégagé les restes du sanctuaire d'Osiris, à Abydos, et il est descendu dans le sous-sol jusqu'aux ruines des édifices de l'époque thinite; il a de plus retrouvé, derrière le temple de Séti I^{er}, le Memnonium souterrain de Ménéphthah, dont les sculptures promettent une riche moisson de représentations et de textes curieux. M. N. de G. Davies a continué de copier quelques-uns des tombeaux d'El-Amarna dans l'intérêt de l'*Archaeological Survey*. MM. Newberry et Tytus ont relevé une partie nouvelle du palais d'Aménôthés III, au sud-ouest de Médinet-Habou. M. Mond a vidé et nettoyé entièrement cinq des tombes de Cheikh Abd-el-Gournah. Enfin MM. Grenfell et Hunt ont recueilli à Bahnèsâ, dans les décombres de l'antique Oxyrrhynchus, une riche collection de papyrus, dont plusieurs leur ont rendu des fragments inédits d'auteurs classiques.

En exécution de la décision prise en 1902 par le Comité d'archéologie, aucune concession nouvelle n'a été accordée aux amateurs qui avaient demandé l'autorisation de fouiller. Le Service, lui non plus, n'a pas entrepris de fouilles proprement dites, mais, en exécutant le déblaiement de la pyramide d'Ounas, à Sakkarah, M. Barsanti a rencontré un grand puits d'époque saïte, celui d'un amiral Hikoumsaouf, dont la momie a enrichi le Musée de beaux bijoux en or et en pierres dures. M. Carter a, comme je l'ai dit plus haut, ouvert l'hypogée de Thoutmôsis IV, puis il a attaqué l'hypogée de la reine Hatshepsoutou, le tout aux frais de M. Théodore Davis. M. Baraize a relevé et mis au net trois autres feuilles du plan de la nécropole thébaine.

Mais, si nous avons dû restreindre encore nos fouilles personnelles, nous avons imprimé un développement considérable à nos travaux de réfection et de consolidation des monuments existants. J'avais chargé, l'an dernier, M. Barsanti de préparer les édifices de Philæ à recevoir le choc de l'eau: l'épreuve de cet hiver justifie la confiance que j'avais mise en lui, comme aussi elle a tourné à l'honneur de MM. Ball et Taylor, à qui le Ministère des Travaux publics avait confié le soin de raffermir le sous-sol de l'île et les fondations des monuments. Les dégâts subis par les reprises et les soutènements récents ont été absolument insignifiants, et les quelques retouches que nous avons été amenés à y faire n'ont pas atteint la somme de 10 L.E. D'autre part, les monuments sont sortis sains et saufs du bain prolongé qu'ils avaient subi. Il est vrai que le mur du temple de Rome et d'Auguste s'est écroulé, mais sa chute ne pouvait être évitée: tous les autres temples sont intacts. Nous avons donc

toute raison d'être satisfaits et d'espérer pour le mieux; néanmoins, il sera prudent d'attendre cinq ou six années encore, avant de porter un jugement sur le sort qui attend Philæ. Les sels ont foisonné en effet aux points de rencontre de l'air et de l'eau sur la surface de la pierre, et la bande humide qui cerne la base de toutes les murailles m'inspire des craintes. Des lavages minutieux nous ont débarrassés des efflorescences, mais nous sommes désarmés contre l'humidité permanente et contre les actions diverses qu'elle pourra produire à l'intérieur des blocs de grès.

J'avais signalé l'an dernier l'état précaire dans lequel se trouvait une portion du mur occidental du temple d'Horn à Edfou, et l'urgence qu'il y avait de le reconstruire. M. Barsanti s'est rendu sur les lieux à la fin de mars 1903, en compagnie de M. Carlo Oropesa et du réis Khalil, et il a procédé, sur une longueur de 85 mètres, à la démolition du mur menacé. A mesure que les blocs descendaient, il les enmagasinait régulièrement à l'ouest du temple. La dépose achevée, il a consolidé les fondations en les garnissant sur leurs deux faces d'un banc de béton qui en a triplé la largeur. Il n'a quitté les lieux que dans les premiers jours de juillet, malgré la chaleur torride qui n'avait presque pas cessé de sévir depuis le début des opérations, et il a réouvert ses chantiers dans la première quinzaine de novembre. A la fin de décembre 1903, dix assises étaient remontées déjà à leur place primitive. M. Barsanti a ordre de s'arrêter lors qu'il aura atteint la quatorzième ou la quinzième assise, et de laisser les portions reconstruites tasser jusqu'à la fin de l'inondation prochaine: l'œuvre sera terminée en décembre 1904 ou en janvier 1905 au plus tard. Les dépenses, imputées sur notre fond des touristes, et, par autorisation spéciale de la Caisse de la Dette, sur le fonds de Philæ, ont été:

				L. E.	M.		
De mars à fin juin	...	{	Restaurations	173	475	}	sur fonds
			Transport du personnel	12	761		de
			Achat et transport de matériel	813	743		Philav.
				<u>998</u>	<u>979</u>		
				L. E.	M.		
En juin et juillet...	...	{	Restaurations	285	170	}	sur fonds
			Achat et transport de matériel	35	625		des
							touristes
				<u>320</u>	<u>795</u>		
				L. E.	M.		
De nov. à fin dec....	...	{	Restaurations	197	640	}	sur fonds
			Transport du personnel	18			de
			Achat et transport de matériel	60	395		Phike
				<u>275</u>	<u>1035</u>		

soit en tout L.E. 1596.809 dont L.E. 1276.016 sur le fonds de Philae et et L.E. 320.795 prises sur notre fonds des touristes.

A Karnak, M. Legrain a rebâti, jusqu'à la hauteur de six mètres environ, dix des onze colonnes renversées en 1899. Il a, de plus, tout préparé pour le démontage de deux autres colonnes, dont j'avais constaté le mauvais état au mois de janvier, pendant mon inspection: il a dressé autour d'elles les pylônes de terre usuels, et il a profité de l'occasion pour déblayer les portions du mur septentrional de la salle qui faisaient face à la ville antique. Il a de même poussé activement l'aménagement de la cour située au sud-est de la Salle Hypostyle. Il y a recueilli la plupart des bloes qui manquaient encore à la porte d'Aménôthès 1^{er} dont j'avais signalé l'existence parmi les remblais, dans mon rapport de l'an dernier: nous la reconstruirons peut-être en 1904, et nous enrichirons Karnak d'un monument dont le souvenir était perdu depuis trente-quatre siècles. Au cours de ces opérations, et pendant la dernière quinzaine de décembre, M. Legrain a eu la bonne fortune de mettre la main sur une véritable mine d'objets antiques. Il semble que, vers l'époque persane ou du temps des Ptolémées, une sorte de gonffre boneux s'était creusé, à peu près dans le milieu de la cour: on en fit une *pitrissa* pour les monuments hors d'usage qui encombraient le temple, et on le combla avec tout ce qu'on avait de monuments et de débris dans le voisinage. M. Legrain a retiré déjà de cette poche onze statues variant d'âge entre la XII^e et la XXX^e dynasties, la plupart intactes, quelques-unes fort belles qui, toutes, sont allées enrichir le Musée du Caire: elle nous réserve à coup sûr d'autres surprises.

M. Legrain avait reçu en outre la mission de nettoyer la région qui s'étend entre le sanctuaire de granit et la Salle Hypostyle, au nord de l'allée centrale. Il a déplacé l'énorme fragment d'obélisque en granit qui écrasait le mur de Thoutmôsis 1^{er}, dégagé l'allée centrale, relevé, dans la mesure du possible, les parties détruites des pylônes et les colosses Osiriens de Thoutmôsis 1^{er}. Il a découvert à cette occasion la salle du couronnement de Thoutmôsis III, des bas-reliefs représentant le retour triomphal d'Aménôthès II après sa campagne victorieuse en Syrie, un beau groupe bien conservé de Thoutmôsis IV et de la reine Tiâ. C'a été, en somme, la campagne la plus fructueuse qu'on ait faite à Karnak, depuis les grandes campagnes de Mariette, et la dépense totale en a été seulement, du 1^{er} janvier au 31 décembre:

	L.E.	M.
Remontage des colonnes	721	985
Déblaiements	698	970
Personnel	224	297
Achat et transport de matériel	351	748
	<u>2000</u>	<u>000</u>

Il convient d'ajouter, pour compléter ce tableau, l'indication de quelques travaux exécutés au moment du *sébakh*, dans plusieurs localités de la Haute et de la Basse-Égypte. De même, des portes ont été mises à divers tombeaux qu'il importait de protéger contre les déprédations des fellahs, nous avons acheté quelques objets en province, et nous avons accordé des gratifications modestes à plusieurs personnes qui nous avaient signalé des monuments intéressants. Tout compris, l'ensemble de nos dépenses, abstraction faite des sommes consacrées à Edfou et à Karnak sur allocation spéciale, a été, pendant l'année 1903, sur les deux chapitres *Fouilles* et *Compte Touristes*, ce qui suit :

	L. E. M.	
Sakharah	424	012
Mit-Rahineh	17	690
Guizeh	8	680
Kinan-Farès	11	040
Zaouiet-el-Amouat	7	
Achmounein	12	365
Tounah	0	600
Balan-sourah	3	240
Biban-el-Moulouk	64	320
Assouan	0	320
Koubbet-el-Haoua	46	700
Transport de matériel et d'antiquités et réparations	113	712
Gratifications pour objets signalés	23	665
Achats	408	380
Total L.E.	1141	724

La plupart des objets que nous avons achetés provenaient de fouilles illicites, et ils avaient été saisis par nos inspecteurs après dénonciation. Bien que nous eussions pour presque tous la preuve suffisante du détournement, j'ai préféré donner quelque argent aux coupables, afin d'éviter des procès que, dans l'état actuel de la législation, nous aurions perdus très probablement, malgré notre droit. Un seul sarcophage en pierre d'époque Ramesside, volé à Tounah, et dont la cuve avait été mise en pièces par les inventeurs, nous a coûté de la sorte environ L.E. 230. Il est regrettable que l'État soit forcé de dépenser de pareilles sommes pour récupérer son bien légitime.

III. — LE MUSÉE ET LES PUBLICATIONS DU SERVICE

Dans mon rapport de 1902, j'avais exprimé la crainte que nous n'eussions dépassé de quelques centaines de livres la somme de L.E. 8500 qui nous avait été allouée pour notre déménagement. Les comptes n'étaient pas apurés complètement, au moment où j'écrivais, et nous ignorions encore l'étendue de nos engagements vis-à-vis de l'Adminis-

tration des Chemins de fer de l'État. J'ai eu, depuis lors, la satisfaction de constater que les chiffres prévus par moi n'avaient pas été atteints, et que notre dette était moindre que je ne l'avais supposé. Nos opérations, loin de nous laisser en déficit de quelques centaines de livres, se soldent par un bénéfice d'environ L.E. 80. C'est un fait que je suis heureux d'enregistrer.

A mesure que nous connaissons mieux notre logis neuf, les défauts qu'il présente deviennent évidents et nous essayons de les corriger. L'un des plus saillants et sur lequel j'ai attiré, dès le début, l'attention des architectes, était la surabondance de lumière et l'excès de chaleur qui en résultait. Dès le lendemain de l'installation, j'avais fermé toutes les ouvertures pratiquées dans la muraille extérieure du premier étage et les claustra qui bordent la partie haute de la galerie centrale: des châssis en bois léger, garnis de gros papier bitumé et revêtus sur leurs deux faces d'un fort calicot sur lequel on passa par la suite une couche de badigeon blanc, nous permirent d'arriver à nos fins pour un peu moins de L.E. 20. Les galeries latérales du premier étage y gagnèrent, mais le mieux ne se fit pas sentir dans les atriums à deux étages: le jour continua d'y tomber en larges nappes de clarté brutale et crue, blessant les yeux des visiteurs ou des employés du Service, et dénaturant l'aspect des monuments. Pendant le printemps et l'été de 1902, la température se maintint si élevée que certaines de nos peintures grecques à la cire fondirent à moitié; la couleur de plusieurs cercueils s'écoula, les montures en fer de plusieurs des vitrines qui abritaient les momies royales se faussèrent, et les glaces qu'elles encadraient se fêlèrent par la dilatation du métal. Des rideaux de toiles de Vichy teinte en bleue furent placés aux fenêtres du rez-de-chaussée, et, tamisant le jour, ils y rendirent la chaleur supportable; mais il fallait user de moyens plus radicaux pour le premier étage, et le Ministère voulut bien, sur mes instances réitérées, remplacer les vitrages en toit à double pente qui recouvraient nos atriums par les lanternaux cubiques, à fond plein, à éclairage latéral, semblables à ceux de l'ancien musée de Boulak. Cette modification, commencée en mai par la Direction des Bâtiments civils, a été achevée dans les premiers jours de décembre, et les conséquences en sont tout à l'avantage de nos collections: la lumière pénètre en quantité suffisante dans les salles du rez-de-chaussée et n'est plus dangereuse dans celles du premier étage. Nous devons toutefois compléter l'effet de cette transformation par un système de rideaux ou de volets dont nous ferons l'essai pendant l'été de 1904.

Le Musée nous avait été livré presque nu. Au rez-de-chaussée, une bande de peinture rouge, à l'huile, couvrait les soubassements jusqu'au

tiers de la hauteur, mais, partout ailleurs, les murs avaient été simplement passés au blanc. Après avoir étudié la question près d'une année, je me décidai à tenter, sous ma propre responsabilité, un essai de décoration du rez-de-chaussée. Le style général de l'édifice et le soubassement rouge qu'on lui avait donné nous imposaient le parti pompéien : il me parut qu'il fallait relever la bande préexistante aux deux tiers de la hauteur, de manière à former un fond sur lequel les statues s'enlèveraient tout entières en vigueur. Je choisis, pour le tiers supérieur, un ton crème à la détrempe, et pour les chapiteaux des piliers un modèle à fond rouge qui rappellerait les soubassements et qui ferait la transition entre la tonalité violente du bas et les tonalités douces des plafonds. J'attribuai à ceux-ci une nuance d'un bleu très léger, qui atténuât encore la lumière et dont le reflet enveloppât les monuments d'une atmosphère plus calme et plus fine que celle dans laquelle ils se trouvaient présentement. L'ensemble, exécuté dans la Salle M sur mes indications par le peintre du Service, M. Carlo Oropesa, en août et septembre, retouché puis simplifié par moi au début de novembre, plût au Comité d'archéologie et à la Direction des Bâtiments civils : je demandai au Ministère de vouloir bien s'en remettre à nous du soin de décorer le rez-de-chaussée. On pensa, comme moi, que nos peintres, dressés au respect de l'antiquité et surveillés directement par M. Oropesa, risqueraient moins de tacher les monuments que les ouvriers des entrepreneurs ordinaires : nous étions d'ailleurs assez bien outillés pour accomplir notre tâche de façon très économique. Le Ministère voulut bien mettre à ma disposition une somme de L.E. 512 qui suffira largement. M. Oropesa s'est attelé à la besogne en décembre 1903 et il aura tout achevé en mars 1904 : nous nous occuperons ensuite de chercher des motifs et des tons qui conviennent aux salles du premier étage.

D'autres améliorations sont à l'étude et pourront être opérées en 1904. Grâce à l'intervention amicale de Sir Eldon Gorst, le Ministère des Finances nous avait cédé, outre les marbres du grand escalier de Guizéh, tous les marbres, toutes les vitreries et toutes les ferrures de ce palais que je jugerais utiles à l'installation du Musée nouveau. J'ai pu recueillir ainsi un nombre de balustres, de mains-courantes et de plaques assez considérable pour qu'il soit possible de substituer un dallage en marbre aux ciments de la galerie d'honneur, et de remplacer les balustrades et les rampes en maçonnerie pleine qui déparent le premier étage de cette même galerie, et les escaliers par des balustrades et des rampes de marbre à jour. Ces changements s'opéreront par les soins de la Direction des Bâtiments civils, au printemps de 1904, après le départ des touristes ; sur ma demande, on profitera de la circonstance pour supprimer les

malencontreuses ouvertures ovales qui éclairent l'antichambre des deux escaliers principaux et pour mettre à leur place un plafond en verre.

L'exèdre bâti autour du sarcophage de Mariette a été achevé en novembre 1903, et la statue en bronze qui doit l'orner a été expédiée de Paris par le sculpteur Puech, dans la dernière quinzaine de décembre: elle sera mise en place par M. Barsanti, et nous espérons que l'inauguration pourra en avoir lieu en mars 1904.

Les bâtiments du secrétariat nous ont été livrés au mois de septembre et les bureaux y ont été installés aussitôt par les soins de M. Bazil. Les pièces qu'ils avaient occupées à l'intérieur du Musée ont été aménagées aussitôt, l'une en cabinet pour le Directeur Général, qui n'avait point sa place dans le Musée et qui avait reçu un asile provisoire à la Bibliothèque, l'autre en salle de réunion pour le Comité d'archéologie qui siégeait naguère au Ministère des Travaux publics. Les aménagements nécessaires ont été faits avec les huisseries et les verrières que le Ministère des Finances nous avait autorisés à prendre au palais de Guizé.

Le classement des collections a progressé sans relâche. Au rez-de-chaussée, nous avons réussi à trouver un emplacement définitif en bonne lumière, pour la plupart des monuments sur lesquels il convenait d'attirer l'attention du public, et, comme conséquence de cet arrangement modifié, nous avons rectifié la numérotation de l'ensemble. Nous avons substitué aux numéros noirs, sans suite, qui étaient propres au Musée de Guizé, des numéros rouges qui se continuent de salle en salle: j'ai laissé dans la série des lacunes qui permettront d'y insérer les monuments nouveaux à leur rang, sans qu'il soit besoin de la bouleverser tous les deux ou trois ans. A mesure que l'œuvre avançait, j'ai remanié les parties du *Guide* imprimé l'an dernier, qui correspondaient aux salles du bas, et j'en ai corrigé les erreurs ou complété les notices: M. Quibell a traduit le texte ainsi revu en anglais, avec la collaboration de M^{me} Quibell et de Miss Pirie, et cette traduction a été mise en vente dans les derniers jours de décembre. Une traduction arabe, due à la plume d'Ahmed bey Kamal, est sous presse et paraîtra dans le courant de l'année 1904. Tant que l'édition française de 1902 ne sera pas épuisée, les monuments du rez-de-chaussée qui y sont décrits garderont l'ancienne numérotation noire à côté de la numérotation rouge: les vieux numéros ne seront enlevés que le jour où nous serons en mesure de réimprimer le texte français. En attendant, et pour faciliter la recherche aux visiteurs, j'ai affiché dans chaque salle un plan, sur lequel les monuments décrits figurent seuls et sont indiqués par une teinte rose. J'ai de plus, posé sur chacun de ces monuments une grande étiquette à la main, où l'on lit, au-dessous du numéro rouge, une notice sommaire en anglais, en arabe et en fran-

çais. Par malheur, les *poissons d'argent* en ont rongé déjà une partie: j'étudie les moyens de remplacer les étiquettes écrites à l'encre de Chine par des étiquettes imprimées dont l'encre grasse résistera mieux aux insectes destructeurs. Le temps m'a manqué de remanier les salles du premier étage. Nous y avons pourtant fini de garnir le pourtour de la galerie d'honneur avec des armoires vitrées et des momies appartenant à la série des grands-prêtres d'Amon. Nous avons installé les objets provenant du tombeau de Thoutmôsis IV dans la salle qui renfermait déjà les objets découverts chez Thoutmôsis III et chez Aménôthès II. Nous avons vidé presque entièrement la salle d'anthropologie, dont le contenu est passé dans les collections de l'École de Médecine, et nous n'en avons retenu que les pièces nécessaires à l'histoire de l'embaumement. En revanche, nous avons organisé une salle nouvelle pour la Faune et pour la Flore momifiée de l'antique Égypte. M. Lortet, doyen de la Faculté de Médecine de l'Université de Lyon, nous avait prié, en 1899, d'instituer des fouilles aux frais de son Université en vue de rassembler des momies d'animaux: pourvu que nous lui permissions de conserver les doubles, il s'engageait à nous renvoyer au Caire la série complète des squelettes et des cadavres montés et préparés, et à les installer dans nos vitrines par les soins d'un des naturalistes de son Muséum, sans qu'il nous en coûtât rien. Le Comité d'Archéologie avait accepté la proposition, et l'arrangement était entré en vigueur au profit de tous les intéressés, mais j'avais toujours remis l'inauguration de la collection au moment où le musée serait établi dans les bâtiments nouveaux. Au mois de décembre dernier, M. Gaillard, aide-naturaliste au Muséum de Lyon, est arrivé avec ses caisses et il a procédé, avec le concours de M. Daressy, à l'accomplissement des promesses de M. Lortet. Il m'a paru utile d'exposer partout, à côté des squelettes ou des cadavres déshabillés, les momies des animaux de chaque espèce recueillies dans les hypogées: j'y ai même adjoint les bois que nous possédons et l'herbier que M. le professeur Schweinfurth a bien voulu préparer pour nous depuis 1882, avec les fleurs trouvées sur les momies royales à Dêir el-Bahari. C'est, on le voit, un musée unique au monde que nous avons constitué, sans autres frais pour le Service que la confection de quelques vitrines. Nous l'avons établi vis-à-vis de la salle des bijoux, dans la galerie qui surmonte la portion sud-ouest de la façade principale. L'an prochain, quand nous aurons transporté les bijoux dans le local que je leur ai destiné à l'autre extrémité des galeries, je mettrai à leur place nos admirables collections de silex taillés.

Nos publications se sont développées de la façon la plus encourageante. Les *Annales du Service* ont terminé leur quatrième volume, et je me suis

efforcé d'y multiplier les planches. J'ai déjà dit que l'édition anglaise du *Guide* avait paru et que l'édition arabe s'imprimait. Notre grand Catalogue s'est enrichi de sept volumes, celui de Daressy sur les *Textes et Dessins magiques*, celui d'Edgar sur les *Greek Monbils*, celui de Grenfell et Hunt sur les *Greek Papyri in the Cairo Museum*, celui de Bissing sur *Die Fayenzengefässe*, celui de Strzygowski sur *Die Koptische Kunst*; enfin le quatrième volume de Lange-Schäfer sur les *Grab- und Denksteine des Mittleren Reichs* a vu le jour ainsi que le premier de M. Lacau sur les *Sarcophages antérieurs au Nouvel Empire*. Neuf autres volumes sont sous presse, ceux de Chassinat sur la *Seconde trouvaille de Dér el-Bahari*, de Milne sur les *Stèles Grecques et Romaines*, de Spiegelberg sur une partie de nos *Textes Démotiques*, de Carter et Newberry sur le *Tombeau de Thoutmôsis IV*, d'Edgar sur les *Greek Bronzes*, d'Ahmed bey Kamal sur les *Stèles hiéroglyphiques d'époque ptolémaïque et romaine*, de Quibell sur les *Archaic Objects*, plus la troisième partie du catalogue de Lange-Schäfer et la seconde de celui de Lacau: la plupart d'entre eux paraîtront dans le courant de 1904. Nous avons enfin en préparation huit volumes, de Lacau sur les *Stèles du nouvel empire*, de Daressy sur les *Statues et statuettes de divinités*, de Maspero sur les *Sarcophages en pierre des époques saïte et grecque*, d'Ahmed bey Kamel sur les *Tables d'offrande*, de Newberry sur les *Scarabées* et sur les *Statuettes Funéraires*, de Weigall sur les *Pouls*, de Bissing sur les *Vases en pierre*, d'Edgar sur les *Grecô-Egyptian Glass*. J'ajouterai que, profitant de la présence de M. Gaillard, je l'ai chargé de rédiger le Catalogue de la salle des animaux, et, qu'usant de la faculté que le Comité m'a accordée d'engager pour quelques mois les savants de passage en Égypte, je me suis assuré le concours de MM. Dyroff, Moret et Bénédite pendant l'hiver de 1903-1904. Les frais de rédaction et d'impression sont, cette fois encore, couverts par les L.E. 2,000 que la Caisse de la Dette veut bien m'attribuer à cet effet chaque année, et par les économies que j'ai pu réaliser sur les fonds qu'elle m'avait accordés pour le même emploi pendant les années précédentes.

Je suis heureux d'annoncer que le second volume du *Dahchour* de M. de Morgan est enfin terminé, et que le second fascicule du tome deuxième de son *Kom-Omba* est à l'impression, ainsi que le premier fascicule du tome deuxième du *Musée Égyptien*. Dès que l'achèvement de ces ouvrages aura rendu disponibles les fonds sur lesquels ils étaient imputés, je reprendrai la publication du *Catalogue général des monuments de l'Égypte* avec le *Karnak* de Legrain et le *Mélinet-Habou* de Daressy.

Notre bibliothèque a continué de s'enrichir: elle a acheté ou reçu en don, cette année, un millier de volumes et de brochures nouvelles. J'ai

dû m'adjoindre les services d'un employé spécial, M. Ducrot, pour la mettre en ordre, la classer et en rédiger le catalogue. Les opérations préliminaires de cette entreprise ont pris fin en décembre. La confection des fiches commence, et j'espère que nous ne reverrons plus reparaitre le désordre qui nous a fait perdre naguère quelques-uns de nos volumes les plus précieux.

Exposition Universelle de Saint-Louis. — Cette année, le gouvernement égyptien, renouant une tradition interrompue depuis un quart de siècle, décida de participer à l'Exposition Universelle qui s'ouvrira à Saint-Louis d'Amérique, en avril 1904, et le Service des Antiquités fut prié de collaborer à l'organisation de la section égyptienne. L'invitation me fut transmise au mois de mai 1903 ; en même temps avis me fut notifié que le Ministère des Finances plaçait L.E. 2.500 à ma disposition, et qu'en plus, une indemnité journalière de L.E. 2 serait allouée au délégué que nous enverrions installer et surveiller nos collections. Il m'a fallu improviser cette exposition en six mois ; on me pardonnera, je l'espère, si elle n'est pas aussi complète que je l'aurais faite, prévenu plus tôt. Je me suis décidé à y introduire deux éléments différents : des reconstitutions exactes des scènes de la vie antique ; des séries de pièces originales, choisies de manière à donner une idée suffisante des monuments qui nous font connaître la civilisation égyptienne.

Ce plan sommaire approuvé par le Ministère des Travaux publics, je commandais à M. Hébert, sculpteur attaché au Musée d'Ethnographie de Paris, et à qui j'ai eu à faire plusieurs fois pour des restitutions de ce genre, notamment lors de l'exposition de 1889, dix mannequins en plâtre, de grandeur naturelle, représentant dix Égyptiens de l'époque Ramesseide, six femmes et quatre hommes, dans des attitudes diverses. Ils devaient être groupés de manière à former trois scènes :

1^{re} Une dame égyptienne à sa toilette : elle achève de se farder les yeux, et une servante agenouillée lui présente un vêtement.

2^{re} Un fonctionnaire de haute classe, dînant. Il est assis devant un guéridon chargé de mets ; un serviteur l'évente et tient la *goulléh* pleine d'eau, tandis qu'une musicienne et une danseuse exécutent sous ses yeux un intermède de danse et de chant.

3^{re} La fabrication du pain et de la bière. Ces deux opérations ont été réunies, la première étant indispensable à l'autre, et la bière se fabriquant avec une levure de mie de pain. Le tout occupe quatre personnages : deux femmes, dont l'une écrase le grain et dont l'autre cuit les miches ; deux hommes, dont l'un brasse la pâte et dont l'autre poisse les jarres qui doivent contenir la bière, afin d'empêcher qu'elle ne se gâte en vieillissant.

Le corps de ces dix mannequins fut moulé sur le vif, dans les poses que j'avais choisies. Les têtes furent modelées d'après des têtes de statues égyptiennes, celle de la soi-disant Taia, celles de la mère de Thoutmôsis IV et de Thoutmôsis IV lui-même, celle du scribe Joupai, du Louvre. L'ensemble fut peint par M. Hébert et par ses aides, et les perruques furent agencées, sur des modèles que j'avais indiqués, par le perruquier du Théâtre Français.

Ces opérations remplirent une dizaine de semaines, de juillet à fin septembre, mais les caisses n'arrivèrent au Caire que dans les derniers jours de novembre : comme les mannequins avaient souffert pendant la traversée de la Méditerranée ils furent restaurés très adroitement par le sculpteur et par le peintre du Musée, MM. Faughanel et Oropesa. Cependant, l'un de nos menuisiers, M. Andrea Altobello, avait préparé, d'après des originaux que j'avais trouvés au Musée, tous les accessoires de chaque scène, lit, chaises, pliants, tables, coffres à linge et à bijoux, objets de toilette, instruments de musique. Brugsch bey avait découvert des étoffes indigènes, de fabrication et de dessin pareils à ceux des étoffes anciennes : une couturière ajusta les costumes sur les patrons que j'avais taillés. L'habillage terminé, chaque scène fut réglée par moi et photographiée par Brugsch bey, pour que notre représentant pût la remettre en place à Saint-Louis dans l'ordre qui m'avait paru le plus propre à en faire valoir le détail.

Le peu de temps qu'on m'avait accordé ne m'aurait pas permis d'opérer de fouilles spéciales en vue de me procurer tous les objets dont nous avions besoin. J'ai pu tirer de Sakkarah un mastaba complet de la IV^e dynastie, mais il m'a fallu emprunter une partie des autres monuments aux réserves du Musée et acheter le reste aux marchands d'antiquités. Néanmoins, je pense que l'ensemble intéressera les visiteurs de l'Exposition. Je me suis efforcé de leur montrer une série funéraire aussi riche que possible, et, à cette intention, j'ai expédié, outre le mastaba, un beau sarcophage carré, en granit rose, de la IV^e dynastie, sans inscription, deux cercueils carrés de la XII^e dynastie, déconverts à Siout cette année même, trois cercueils anthropoïdes avec momies de l'âge Ramesside et de l'époque grecque. Le mobilier comprend quelques chevets en pierre ou en bois, quelques bateaux, quelques coffrets à statuettes, un choix de *répondants* des types les plus variés, des amulettes, des colliers, des perles en émail multicolore ou en pierres dures. Un bon choix de statuettes en bronze et en terre émaillée donnera quelque idée de la religion égyptienne, mais la peinture et la sculpture ne seront représentées par aucun objet de valeur, en dehors des bas-reliefs de notre mastaba : nous n'avons pu envoyer que des moulages dont le plus important, celui de

notre Khéphrén, a été peint par M. Oropesa et reproduit très exactement l'aspect de l'original.

Sur le refus de M. Brugsch bey, M. Quibell a bien voulu se charger d'aller installer notre section et de la surveiller pendant les premiers temps au moins. Pour lui faciliter la mise en place, j'ai fait fabriquer au Musée toutes les boises des armoires nécessaires : il n'aura plus qu'à en assembler les pièces et à les garnir de verres loués à Saint-Louis même, et, en quelques jours, tous les petits objets de notre envoi pourront être exposés. Le remontage du mastaba sera un peu plus long, mais le numérotage des caisses qui le contiennent est tel, qu'aucune erreur n'est possible dans l'appareillage des blocs. M. Quibell a de plus une liste des prix dressée par Brugsch bey avec les indications nécessaires pour les majorer de toute la quantité qu'il estimera utile à couvrir les frais de transport, d'aménagement et de gardiennage. L'emballage sera terminé vers le 25 janvier, et, à partir de cette date, le convoi entier et M. Quibell lui-même seront à la disposition de M. le Commissaire Général.

Les dix mannequins nus ont coûté chacun 500 francs : rendus au Caire, habillés, pourvus de leur mobilier et de leurs accessoires, l'ensemble des trois scènes nous est revenu à L.E. 300 environ. Le mastaba, emballé et prêt à partir, représente un peu plus de L.E. 200. Il nous a fallu dépenser environ L.E. 700 pour nous procurer le reste de la collection par fouille ou par achat. D'autre part, j'avais prélevé L.E. 1000 pour les frais de voyage et d'installation à Saint-Louis : L.E. 300 ont été remises à M. Quibell, et L.E. 700 à M. Lawford. Afin de me couvrir contre toutes les erreurs de prévision possibles en pareille matière, j'ai mis à part L.E. 300 qui, au cas où nos calculs auraient été justes, pourront être employées, dans la suite, à compléter par de nouveaux envois d'Égypte, celles de nos séries que M. Quibell, étant sur les lieux, jugera convenable de renforcer. L'exposition close, tous les objets sans exception seront vendus, et, pour peu que l'opération soit conduite avec soin, je pense que le produit en sera assez considérable pour rembourser le Trésor Égyptien de ses avances, en partie sinon en totalité.

Je ne puis mieux terminer ce rapport qu'en y joignant l'état comparatif de nos recettes hors budget, pour les deux saisons 1901-1902 et 1902-1903 :

NATURE DES RECETTES.	1901-1902.		1902-1903.		En plus pour 1902-1903		
	L. E.	M.	L. E.	M.	L. E.	M.	
Touristes.. .. .	3,796	500	3,951	100	154	600	
Salle de vente.. .. .	926	610	1,050	885	124	275	
Entrée au Musée	625	550	714	090	88	540	
Publications- {	Publications.. .. .	242	670	574	072	331	402
	Chakfs	378	582	543	841	165	259
TOTAL.. .. .	5,969	912	6,833	988	864	076	

On voit que l'augmentation est sensible sur toute la ligne : elle tient, pour le fonds des touristes et pour les *chakfs*, à l'activité de nos agents et à la surveillance plus efficace qu'ils exercent sur leurs districts. J'estime pourtant que la fraude sur les billets enlève encore un cinquième environ de la recette, et que nous touchons à peine la dixième partie de ce que les *chakfs* devraient nous rapporter : j'essaierai de remédier à cet état de choses, mais on sait combien la fraude est difficile à découvrir en pareille matière, et il s'écoulera des années avant qu'elle soit réprimée complètement.

G. MASPERO.

REPORT ON AGRICULTURAL RAILWAY LINES

1903

BY

JAMES A. GUNN.

REPORT ON AGRICULTURAL RAILWAY LINES.

Cairo, 26th March, 1904.

SIR WILLIAM GARSTIN, K.C.M.G.,
*Under Secretary of State,
Ministry of Public Works.*

SIR,

General Remarks.—In reviewing the working of the Light Railways for 1903, I have the honour to state that there has been a very sound improvement in every way. The receipts have increased notwithstanding the fact that the year has been a rather unfavourable one, owing to a shorter cotton crop and other drawbacks, such as cattle plague and the fact that no Moulids were held, all of which considerably affected the traffic. In addition to this, the lines had no unusual augmentation as was the case during the previous year for large irrigation works.

The kilometrage has not been materially increased, but a great deal of work has been done and large sums have been expended in lengthening sidings, reducing gradients, and more fully equipping the lines with engines and vehicles. A more highly paid staff has been found necessary in order to handle the traffic. The Companies do not give a uniform service, nor can it be expected of them, as some districts are so much more remunerative than others, but where the traffic warrants it, they give the public a very good service. Special goods trains are frequently needed to relieve the traffic, and the Companies should be encouraged whenever it is necessary to run these specials to ensure a more regular service.

There have been considerably over four and a half million (4,783,885) passengers carried during the past year, and only few complaints recorded, most of which were due to irregular train service. There is, however, a marked improvement in this direction, and I think all the Companies are beginning to realize that an irregular service is damaging to themselves; it is, however, largely minimized by the number of specials they are running.

Tariffs.—The question of tariffs is now before the Light Railway Commission. The note which I have prepared on this subject has been

laid before the Commission and is appended hereto. The chief points of which are :—

1st. The advisability of only fixing a maximum for all classes as laid down by the Concession.

2nd. After the classification has been accepted by the Government, there is no need to fix a minimum.

3rd. That undue competition should be avoided, adhering to rule B recommended by the Commission in September, 1902.

4th. That the Companies should be allowed to change their rates between the maxima of one class to the maxima of the next class below, without applying to the Government.

The lifting of unremunerative lines.—There have been one or two cases of this nature before the Commission: one in Fayoum and one in Lower Egypt. The former Company was allowed to do away with the line, but in the latter case sanction was withheld. I would suggest that some fixed rules should be adhered to in deciding these matters. In the East Province the lines seem to have been laid without due consideration. The present owners naturally wish to be relieved of the onus of keeping up an unremunerative line; the section in Charkieh through which it runs from Borden to Borden junction is certainly well served by the Government lines and the land-owners adjoining the light railway line do not appear to use it at all. In the case of the Fayoum, very much the same circumstances exist, but they have not yet availed themselves of the permission to lift their line. I would recommend that if a Company can satisfy the Government that the lines are not being, or likely to be used by the land-owners adjoining after a fixed time for trial, say three years, that they should be allowed to lift their lines.

Level crossings.—Although it is generally admitted that level crossings are not desirable, yet it would be almost impossible to insist upon over and under bridges for every crossing; the country is small and closely intersected with agricultural and Decauville lines, the former of which must, of necessity, frequently cross the trunk lines. There are cases where only a few trains are run and these at very low speed, when it would seem that danger is reduced to a minimum, for instance on the line between Cherbine and Kalline where level crossings are applied for, there are only three trains a day with an interval of about six hours between each. The crossings could be made near the stations with a system of signals and interlocking devices, if necessary, and under the control of the Government Railways' Station Master. The opposition

shown by any Government officials to any trains crossing their lines might almost be considered a guarantee of safety in itself. At Benha where there is a margin of twenty minutes allowed for crossing, if the light railway train is even two minutes late, and they try to make a crossing, the signals are closed against them.

Working jointly with the Government line.—The working of the joint stations has, during the last year, been noticeably better in all Provinces. Goods have generally been promptly transhipped and few complaints have been made for delays by any of the railways, even during the heaviest season. All the Light Railway Stations have not yet been opened by the Government Railway for through-booking, which is asked for by the Companies. If this is allowed it would no doubt prove a benefit to all.

Location of the line.—This is important from an economical and working point of view. There are many instances of badly placed lines, and the Companies more fully realize the necessity of careful location, as they are taxed to the utmost in maintaining and repairing rolling stock on badly placed lines. The damage to stock and permanent way is heavy and incurs great expense. It is, besides, most wearing to the train staff and particularly to the engine drivers to have a line that follows too closely the sharp curves of the agricultural road. With the constantly increasing traffic many changes will be necessary in order to eliminate the curves: in some places new surveys will have to be made.

Figures giving the number of passengers carried, receipts, etc., are appended in Table No. 1.

Increase of goods.—The total number of tons lifted during the year amounted to 642,969, showing an increase of 48,483 tons over the previous year. Considerably less cotton was carried, but there was a large traffic in building materials, there being a substantial increase in this line during the last two years.

Telephones and Telegraphs.—There were 65 kilometres added to the Egyptian Delta Light Railway Company's lines. In general the work has been much better than last year. If properly organized and extended it might be a useful factor in working the interior of the Provinces and no doubt some arrangements could be made with the Companies, as has been done with the Delta.

Lighting of Trains and Stations.—As trains have to do a good deal of work after dark during the winter months, the lighting of trains and stations should be improved. Several cases of cotton stealing might have been prevented had the lighting been better.

New lines.—Twelve kilometres of lines were added in Lower Egypt for the Delta Company.

In future construction of lines.—No curves in the open country should be less than 100 metres.

Under no circumstances should the lines run directly through villages.

Stations sites should not be situated near public highways.

It would also be satisfactory if some arrangement could be made with the land-owners near stations to avoid crowding and hampering the Companies' works by erecting buildings too near stations. The Government might prohibit the placing of buildings within a reasonable distance of the stations.

Increase of passengers.—The total number of passengers carried by the Companies during the year amounted to 4,783,885, showing an increase on the previous year of 415,001.

The competition with Government lines.—A map is attached showing the Light Railway lines in Lower Egypt and proposed lines. Although it is undoubtedly the case that the Light Railways do compete with the Government lines to some extent, being so closely interlaced with the trunk lines; this is, however, more than made up for by the fact that the Light Railways carry large numbers of passengers and goods to the Government lines. In short they develop travel and traffic, and take it over short leads which would not be profitable to the State Railways.

A significant fact too is that wherever the Light Railways have penetrated, the price of land has gone up enormously not in a speculative sense, but cultivators can go in and find a market practically at their doors by means of these lines.

The boat service must be reckoned with as a very formidable competitor of the Railways, with their long distance transport from the sea South to Assouan and all river ports. The figures received from the Finance Department show that during the last 14 months 1,325 boats of all descriptions have been added to the service, making a total in all

of 22,212 with a total ardebage of 2,534,251, the largest proportion being sailing "Kayassas".

Egyptian Delta Light Railways Company.—The receipts of the Egyptian Delta Light Railways Company to the end of September, 1903, show an increase of L.E. 3,861 over the previous year.

This may be considered very good, as on account of the cattle plague the markets were closed and no Moulids were held, and there was no stone traffic at Zifta Barrage, which in 1902 amounted to L.E.14,426. The cotton crop also affected the receipts.

The Company's working expenses were increased 4% owing to increase of kilometrage and traffic, and a more highly paid staff being engaged.

Receipts and expenditures.—

	1902	1903
	L.E.	L.E.
Receipts	125,610	129,471
Working expenses	77,193	80,420
Nett receipts	48,417	49,051
Working expenses to gross receipts	61.46%	62.12%
Receipts per kilom. per week	3.02	3.09
Expenditure	1.86	1.92
Passengers carried during 1903	=3,636,688	
" " 1902	=3,311,448	
An increase of	<u>325,240</u>	
Goods traffic for 1903	471,529	tons traffic
" " 1902	463,928	do. (Ziftah traffic included)
An increase of	<u>7,601</u>	tons

The Company's corrected measurement is now 813 kilometres. They have constructed in the past year 12 kilometres of line, viz: Samanoud to Kafr Sarem to connect up two sections 7 kiloms.

A branch line to Abon Zaabal Quarries 3 ..

Neureh to Banawan, a short branch length 2 ..

Besides these there have been many sidings laid and lengthened in all their Provinces.

They have now under construction, and the bridge work completed on four different sections, amounting to about 44 kilometres of new line.

Surveys have been made in all the Provinces for connecting up their system and opening up the Province of Menoufieh more fully,

amounting to about 175 kilometres. Detailed plans, etc., for the line in the latter Province have not yet been submitted for approval.

Equipment.—The Company handle a heavy traffic exceedingly well with a shortage in both engines and wagons. The shortage in vehicles would not be felt so much if they had more power to draw the rolling stock. The present types of engines have proved too light and not suitable for the heavy increase of traffic, but they will do for working on new branches where the traffic will be lighter.

The Company is gradually correcting this shortage in equipment, and 12 heavy 25-ton engines

have been received, also the following vehicles :—

5	bogie 1st class carriages	/	each equal to 2 four wheeled
15	„ 3rd „	„	vehicles for purposes of the con-
5	„ break vans	„	cession.
60	„ wagons		

These will very largely help to relieve the congested state of the traffic during the heavy cotton season. With no reserve stock the tax upon the equipment has been very great.

Further orders will probably follow for the work of the new extension.

The maintenance of the Company's lines has generally been good especially in Gharbieh and Behera. In the Provinces of Charkieh and Dakahlieh, owing to the faulty construction of the lines, the work of maintenance has been very heavy and a good riding track cannot be looked for without changes in the alignment, extensive surfacing and possibly new surveys being made. The former owners seem to have consistently neglected the work of surfacing.

The Company's list of accidents during the year has somewhat increased. The majority injured were employees and largely due to their own carelessness. I only notice one fatal accident to a passenger: a boy who fell out of a train and was run over.

Les chemins de fer de la Basse Egypte.—The receipts to the end of June, 1903, show an increase of L.E.1,234 over the previous year.

The passenger traffic is exceedingly good, and to this, the increase is largely due.

There was nothing to noticeably affect the traffic in this section unless it was the closing of the markets on account of the plague. A better service between Mansourah and Matarieh might still further increase the passenger traffic.

Receipts and expenditures.—

	1902	1903
	L.E.	L.E.
Receipts	21,857	23,091
Working expenses	11,150	11,381
Nett receipts	10,707	11,711
Working expenses to gross receipts	51. 0%	47. 6%
Receipts per kilom. per week.. .. .	3.85	4.04
Expenditure	1.96	2. 0
Passengers carried during 1903	668,344	
Passengers carried during 1902	617,443	
	<hr/>	
Increase for 1903	50,901	
	<hr/>	
Goods traffic during 1902	55,008 tons	
Goods traffic during 1903	54,642 ..	
	<hr/>	
Decrease for 1903	366 tons	
	<hr/>	

The Company have not added to their kilometrage of 109.

Equipment.—Their equipment is good and will probably answer for some time to come.

The stock is well maintained and the Company have a good reserve in engine and vehicles. The work on their lines has been better. The maintenance of the banks is with difficulty carried out, as the Company have no sidings into the earth komis. A siding laid to one of these komis should, I think, amply pay for itself, giving a fertilizer to the country, maintaining their banks, and for filling in stagnant pools that surround stations and villages so dangerous to health. There were four accidents during the year one of which was fatal, the others appear to have been through carelessness and the Company do not hold themselves responsible.

Fayoum Light Railway Company.—The receipts of the Company for the year show an increase of L.E. 5,172,345 mill. on the previous year, which is an improvement, but better results would be shown if the lines were more fully connected up. This increase is largely due to a marked development in the Province, the diminishing number of transport camels and donkeys, noticeable after the first year or so wherever light railway lines exist, and the advantages of the system of through-booking with the Egyptian State Railways.

The increase of the working expenses is due to the Company having a more highly paid staff.

Receipts and expenditures —

	1902		1903	
	L.E.	M.	L.E.	M.
Receipts	12,130	247	18,423	698
Working expenses	11,225	769	13,251	353
Net receipts.. .. .	904	000	5,173	000
Working expenses to gross receipts	92 $\frac{1}{2}$ %		72 %	
Annual gross receipts per kilo. ..	84	584	109	665
Annual working expenses per kilo ..	78	174	78	887
Annual nett receipts per kilo	6	410	30	788
Ratio of goods receipts to coaching	74 %		88 %	
Passengers carried during 1903 ..	478,853			
.. .. . 1902 ..	439,993			
An increase of	<u>38,860</u>			
Goods traffic during 1903	116,797	tons		
.. .. . 1902	75,550	..		
An increase of	<u>41,247</u>		tons	

No extensions have been made during the year, the kilometrage remaining at 168.

The maintenance of the lines has improved during the past year. As in other sections in Lower Egypt the location of some of their branches is not good, having many needless curves. This will no doubt be gradually put right when the system is more fully connected and the lines laid so as to thoroughly work the Province.

Two new engines have been added to the Company's stock. The traffic has been handled better, but the train service might be much improved.

No accidents have been reported to passengers.

I have the honour to be, Sir,
Your Obedient Servant,

JAMES A. GUNN.
Light Railway Commission.

NOTE ON TARIFFS FOR LIGHT RAILWAYS, 1904.

The Articles in the Concession touching on the question of tariffs for merchandise will be found in Appendix A of this note.

It will be noticed that the maxima class rates were those of the Egyptian Government Railway at the time Concession was granted. Under Article 37 the Concessioners were allowed to arrange provisionally a classification for submission to the Ministry for approval.

The Companies apparently submitted tariffs or proposals asking for the adoption of rates similar to the Government, which was approved by the Ministry's letter No. 3875 H.H' of the 18th May, 1898, and while approving of this provisionally it was pointed out that it would be preferable if the Companies would carefully examine and ascertain by experience the condition of their traffic before a final decision was given.

Up to April, 1899, the light railways under this sanction apparently worked on tariffs somewhat similar to the Government Railways.

Letters of the 13th and 15th April, 1899, as per annexes, pointed out that the same tariffs should not be applied to light railways as the conditions of traffic were quite different.

The Government, in replying on the 17th April, 1899, No. 1941 decided to give light railways absolute full powers in regard to their tariffs (see this letter), the object being to give the Companies an opportunity to find a suitable tariff and up to this date they have been working in this way, see letter from the Commission of June 26th 1901.

It is obvious from the Concession that the Government's intention was that the Companies should submit tariffs for approval, and that the maximum of each class should not exceed the Egyptian State Railway at the time.

There does not appear as if there was anything laid down requiring the same classification of the State line, and this view is confirmed by the subsequent decision of the Government allowing the Companies full powers to change rates for nearly two years in order that they might find a tariff to suit the conditions of their traffic. Thus it will be seen that the Companies have now had a free hand in the matter of rates for some years and have apparently arrived at a tariff that satisfies the public, as there have been few, if any, complaints.

The classification of the various railways as compared with that of the Government Railways will be found with the Appendix, and it will be noticed the classification for many commodities is different in each line, which is no doubt due to the varying conditions of their traffic.

It would be very difficult to arrange a uniform classification that would suit all railways, and the experience of the Companies tends to show that it would not suit the public in all cases.

The object of uniformity in classification is, I understand, principally to simplify work of through-booking between railways, but in this country all the Companies *are* worked on the tariff of the Egyptian Railway Administration for through-booking. If the Government classification is required of the light railways, I feel certain the result will be that the Companies would ask special rates for most, if not all, of their commodities and eventually return to their present tariffs.

I therefore beg to propose that the Commission should :

(1) Recommend a maximum for all classes as laid down by the Concession which distinctly provides for this (see Appendix A).

(2) If necessary, to adjust any articles of their tariffs, and approve of same not fixing any minima.

(3) That Rule *B* as recommended by the Commission in December, 1902, be enforced, which is as follows : That the rate between any two points between which the State Railways and the Companies both have lines should not be less than the rate calculated on the tariff of the State Railways for the shorter distance.

(4) That the Companies be allowed to change their rates between the maxima of one class to the maxima of the next class below without applying to the Government, viz : for first class between 15 mill.—10 mill. Second class 10 mill.—7 mill. &c. always notifying the Government Railway *of any change*.

Should the Companies want to lower their rates, for example for 1st class below 10 mill. per 10 kiloms., they must apply to the Ministry 30 days ahead for approval.

Should any undue preference be shown, it would no doubt soon be brought to the notice of the Ministry by the agrieved parties.

This mode of procedure would have the advantage of simplifying the control of the Companies' tariffs.

In going over the Companies' tariffs, it can at once be seen how very varied their classification is, and how impracticable it would be to require a uniform classification for all. With the maxima fixed, and rule *B* once enforced, it can make no difference what rates the Companies charge.

AGRICULTURAL RAILWAYS.

Table No. I. DETAILS OF COACHING RECEIPTS. Annual Report, 1903.

Number.	TITLE OF LINE.	Average length of line opened to traffic during 1903.	NUMBER OF PASSENGERS CARRIED.					RECEIPTS.		Year to which figures given refer
			First Class.	Second Class.	Third Class.	Total.	Passengers per kilometre of line opened to traffic.	Average sum paid for each ticket.	Total coaching receipts.	
		Kilometres. Miles.						Mill.	L.E.	
1	Egyptian Delta Light Railway Company ...	$\left. \begin{array}{l} \text{K.} \\ 806 \text{ or} \\ \text{M.} \\ 508\frac{1}{2} \end{array} \right\}$	$\left. \begin{array}{l} 192,069 \\ \end{array} \right\}$	—	3,444,619	3,636,688	4,512	20·8	74,088	(Aug. 1902 to (Sept. 1903.
2	Mansourah-Matarieh ...	$\left. \begin{array}{l} \text{K.} \\ 109 \text{ or} \\ \text{M.} \\ 68\frac{1}{2} \end{array} \right\}$	$\left. \begin{array}{l} 4,703 \\ \end{array} \right\}$	63,225	600,416	668,344	6,048	23·4	15,384	(July 1902 to (June 1903.
3	Fayoum Agricultural Light Railway Company	$\left. \begin{array}{l} \text{K.} \\ 168 \text{ or} \\ \text{M.} \\ 105 \end{array} \right\}$	$\left. \begin{array}{l} 9,884 \\ \end{array} \right\}$	—	468,969	478,853	2,850	19·06	9,520	(Jan. 1903 to (Dec. 1903.

AGRICULTURAL RAILWAYS.

Annual Report, 1903.

DETAILS OF PERMANENT WAY.

Table No. II.

Number.	TITLE OF LINE.	Province.	Term of concession	Date of concession	Approximate length of lines mentioned in concession	Gauge of lines	Weight of rails	Length of lines opened December 1902	Length of lines opened during 1903.	Total length of lines December 1903	Lines under construction.
			Years		Kiloms. Miles.	Metres. Ft. and ins.	Kilosp. lbs. lbs. p. yd.	Kiloms. Miles.	Kiloms. Miles.	Kiloms. Miles.	Kiloms. Miles.
1	Egyptian Delta Light Railway Company ...	Behera (Gharbich) (Charkich) (Dakahlieh) (Kalioubieh)	70	March, May, 1896	K. 514 321 M.	M. 0'75 2 5½"	15 or 32 18 or 39	K. 801 or 500½	K. 13 or mils. 8	K. 813 or mils. 508	K. 41 or mils. 27½
2	Mansourah-Mattarieh and Branch ...	(Dakahlieh ...)	50	June, 1895	K. 100 M. 62	M. 1'00 3' 3¼"	23 or 50 lbs.	109 or 68	(Nil.)	K. 109 or mils. 68	(None.)
3	Fayoum Agricultural Light Railway Company ...	(Fayoum ...)	70	May, 1897	(K. 116 or M. 91)	M. 0'75 or 2' 5½"	15 or 32	168 or 105	(Nil.)	K. 168 or 105	(None.)
		Total number of kilometres ...			760	—	—	1078	13	1090	—
		Total number of miles ...			474	—	—	673	8	681	—

AGRICULTURAL RAILWAYS.

Table No. III. *Annual Report, 1903.*

Number.	TITLE OF LINE.	Average length of line opened to traffic during 1903.	Goods carried.	Receipts from goods.	Receipts from coaching.	Total gross receipts including every thing.	Gross receipts per kilom. including every thing.	Total expenditure.	Annual working expenses per kilom. of line.	Annual net receipts per kilom. of line.	Ratio of working expenses to gross receipts.	Ratio of goods receipts to coaching receipts.
		Kilom. Miles.	Tons.	L. E.	L. E.	L. E.	L. E.	L. E.	L. E.	L. E.	%	
1	Egyptian Delta Light Railway Company	{ K. 806 or 503½	{ 171,530 }	47,232	76,968	129,172	160½	80,120	99.78	60.86	62.12	1 to 1.62
2	Mansourah-Matarieh	{ K. 109 or 68	{ 51,612 }	7,707	15,384	23,091	212	11,384	101.—	107.—	49.28	1 to 1.99
3	Fayoum Agricultural Light Railways ...	{ K. 168 }	116,797	8,536	9,720	18,123	109	13,253	78.—	30.—	71.93	1 to 1.89

REPORT
ON THE
GIZA ZOOLOGICAL GARDEN
For 1903

BY
STANLEY S. FLOWER.

DIRECTOR.

CONTENTS

	PAGE
I.—Staff 	387
II.—Visitors and Gate Receipts 	388
III.—Donors	389
IV.—Buildings 	394
V.—Animals 	397
VI.—Forage	419
VII.—Accounts 	420
VIII.—Aquarium 	421
IX.—Appendix :	
A. Report on Butterflies by Mr. P. P. Graves 	429
B. List of Publications 	430

REPORT ON THE GIZA ZOOLOGICAL GARDEN FOR 1903.

I. STAFF.

<i>Director</i>	CAPTAIN S. S. FLOWER, F.Z.S., M.B.O.U., etc.
<i>Clerk</i>	KAMEL FAHMI EFFENDI.
<i>Storekeeper</i>	SALEH LEBIB EFFENDI.
<i>Gatekeeper</i>	MUSTAFA EL ANTABLI EFFENDI.
.. ..	ISMAIL SOLIMON.
<i>Head Keeper</i>	BAKR AHMED.
<i>Head Carpenter</i>	MOHAMMED EL BEHAIRI.
<i>Head Gardener</i>	IBRAHIM EL HAMZAWI.

One Mahout.	Two Propagators.
Ten Keepers (1st and 2nd class).	Seven Flower-men.
Ten Keepers (3rd and 4th class).	Two Mowers.
Three Night-watchmen.	One Rock-gardener.
One Artizan.	Ten Waterers.
Three Mosaic-pavement repairers.	Ten Path-sweepers.
Two Leading Gardeners.	Four Garden-labourers.
One Tree-cutter.	One Carter.

In all, seventy-six men on monthly pay.

And a varying number of labourers on daily pay.

The Director left Egypt on leave on 17th May and returned on 27th August, during this period Captain H. G. Lyons, Director General, Survey Department, P.W.D., kindly acted as Director of the Zoological Gardens.

II. VISITORS AND GATE RECEIPTS.

(i) *The number of visitors and amount of gate-money as compared with previous years is shown in the following table :—*

YEAR.	VISITORS.	£F.	M.M.
1896	?	481	960
1897	?	766	690
1898	?	937	260
1899	43,567	991	950
1900	44,296	976	130
1901	50,711	1,114	840
1902	47,117	1,037	120
1903	55,937	1,213	420

N.B.—One Egyptian Pound (£F. 1) equals £1. 0s. 6½d. or 25 francs and 92 centimes.

(ii) *Visitors, 1903.*

	Monday-Evening		Sunday afternoon	Week days and Sunday mornings	Sundays and holidays	Sundays and holidays afternoon	TOTAL	Gate-money	
	Paying P.T. 10	Paying P.T. 5	Paying P.T. 5	Paying P.T. 2	Paying P.T. 1	Paying P.T. 1		£F.	m.m.
January.. ...	—	—	841	4,435	1,374	233	6,883	144	490
February ...	—	—	1,177	3,008	566	148	4,899	124	670
March	—	—	1,872	5,610	1,398	683	9,563	219	780
April	265	92	758	3,097	636	530	5,378	137	300
May	—	—	426	2,321	553	183	3,483	73	250
June	—	—	239	2,004	449	151	2,846	56	520
July	—	—	191	1,954	449	288	2,882	53	120
August... ..	—	—	183	1,923	579	139	2,824	53	400
September ...	—	—	173	2,012	432	148	2,765	53	210
October... ..	—	—	278	2,388	618	395	3,679	67	840
November ...	—	—	765	1,830	654	388	3,637	81	390
December ...	—	—	1,003	4,147	1,536	412	7,098	148	450
TOTAL...	265	92	7,906	34,729	9,244	3,701	55,937	1,213	420

III. ALPHABETICAL LIST OF DONORS, AND THEIR DONATIONS
DURING 1903.

ADAMS, MR. Y., Gezira.

1 Parrakeet, *Paltornis torquata* 25th Jan.

AMSTER, DR. R., Sanitary Department, Cairo.

1 Kra Monkey, *Macacus cynomolgus* 6th June.

ANTHONY, MR. H. M., Ministry of Finance, Cairo.

1 Grivet Monkey, *Cercopithecus aethiops* 19th June.

BEADNELL, MR. H. J. L., Survey Department, P.W.D.

1 Desert Fox, *Canis famelicus*... .. 4th Jan.

BUTCHER, MRS., Church House, Cairo.

2 White Java Sparrows, *Monia oryzivora* 2nd Oct.

CATTAUL, MR. GUSTAVE, Cairo.

1 Fox, *Canis vulpes*... .. 4th June.

CHAWARBI MOHAMMED PASHA, Legislative Council, Cairo.

1 Gazelle, *Gazella dorcas* 23rd Jan.

COKE, LIEUT. THE HON. E., Rifle Brigade.

1 Leopard, *Felis pardus* 1st Aug.

CROMER, RIGHT. HON. THE EARL OF, G.C.B., etc., Cairo.

1 Crowned Crane, *Balearica pavonina*... .. 14th March.

DIXON BEY, SANIEH F., C.M.Z.S., Port Said

2 Buff-backed Egrets, *Ardea ibis*... .. 11th Jan.

1 Lesser Black-backed Gull, *Larus fuscus*... .. 17th May.

FLOWER, MRS. S. S., Giza.

1 Hawfinch, *Coccothraustes vulgaris* 6th Jan.

1 Skink, *Mabui quinquevittata* 19th Feb.

1 Quail, *Coturnix communis* 21st March.

FLOWER, CAPT. S. S., Giza.

1 Hedgehog, *Eriodactylus auritus* 19th Feb.

HASSAN BEY TAHIR, Cairo.

1 Imperial Eagle, *Aquila heliaca* 12th April.

HASSAN GAAD, Giza.

1 Weasel, *Mastela africana* 24th March.

HEWENS, MR. J., Sudan Government Railway, Wadi Halfa.

1 Patas Monkey, *Cercopithecus patas* 16th Dec.

HOSAIN HASEEB BEY, "Magalat El Mahalat El Arabeia," Cairo.

1 Patas Monkey, *Cercopithecus patas* 10th Nov.

HUMPHREYS, MR. H. A., Survey Department, P.W.D.

7 Leith's Tortoises, *Testudo leithi*... .. 6th March.

INNES BEY, DR. F. WALTER, M.B.O.C., Kasr el-Aini, Cairo.

1 Lanner Falcon, *Falco feldeggii* 1st May.

ISMAIN BEY SHAKOOR, Cairo.

2 Newts, *Molge cristata* 21st October.

MAHMUD EFFENDI RASMY, Mulazim Awal, Military School, Cairo.

2 White Storks, *Ciconia alba* 28th Sept.

MOHARREM BEY ABU GABEL.

2 Kestrels, *Falco tinnunculus* 19th Aug.

SEDNAOUI, M. GEORGES, Caisse de la Dette, Cairo.

1 Mare, *Equus caballus* 14th Nov.

SHELFORD, MR. R., C.M.Z.S., Sarawak, Borneo.

1 Spinous Terrapin, *Geomyda spinosa* 8th Sept.

SPOTTISWOODE, Major A.A., 72nd Seaforth Highlanders.

1 Grivet Monkey, *Cercopithecus aethiops* 29th Jan.

TALBOT, Major General the HON. SIR REGINALD, K.C.B.

1 Pelican, *Pelecanus onocrotalus*... .. 23rd Feb.

TANZIM SERVICE, Director-General of, P.W.D.

5 Swans, *Cygnus olor* 28th Nov.

TOLBA IBRAHIM, Ombashi, Giza.

1 Bat, *Rousettus aegyptiacus* 15th March.

1 Weasel, *Mustela africana* 12th Oct.

WAKELING, Dr. J. G., Mena House, Giza.

1 Kite, *Milvus aegyptius*... .. 3rd May.

WALLER, Mr. EDWARD, Youzbashi, Alexandria City Police.

1 Monkey, *Cercopithecus aethiops*... .. 27th Dec.

Besides the above donations, the Gardens also received on the 29th Jan. a Catalogue of Birds of Prey in the Norwich Museum from Mr. J. H. Gurney, Keswick Hall, Norwich, England; on the 19th Feb. a Flamingo from an anonymous donor; on the 11th March two maximum and minimum Thermometers from Herr G. Sijsman, Mouski, Cairo, and on the 17th and 19th Dec. several plants from Herr Christian Stamm, Bulac-Daerour Road, Giza.

Thanks are also due to the following Foreign Institutions for presenting copies of their publications:—

Europe.

1. Bale.—Zoologischer Garten in Basel.

Dr. GOTTFRIED HAGMANN, Direktor.

(Jahresbericht 1902).

2. Dublin.—Royal Zoological Society of Ireland.

Dr. R. F. SCHARFF, PH.D., B.Sc., F.Z.S., Secretary.

(Seventy-first Annual Report.)

3. Hague.—Koninklyk Zoölogisch Botanisch Genootschap.

D. N. DIETZ, Directeur.

(Verslag over het jaar 1902).

4. Hamburg.—Zoologischen Gesellschaft in Hamburg.

Dr. HEINRICH BOLAR, c.m.z.s., Direktor.

(Forty-first Annual Report, 1902.)

5. Hannover.—Zoologischer Garten.

Dr. ERNST SCHÄFF, Direktor.

(Report, 1902-1903).

6. Leyden.—Rijks Museum van Natuurlijke Historie te Leiden.

Dr. F. A. JENTINK, F.M.Z.S., Director.

(Verslag, 1902-1903.)

Asia.

7. Colombo.—Colombo Museum, Ceylon.

Dr. A. WILLEY M.A., D.SC., F.Z.S., Director.

(Spolia Zeylanica, Vol. 1. Parts, 1, 2 & 3.)

8. Kuching.—Sarawak Museum, Borneo.

R. SHELFORD, M.A., C.M.Z.S., Curator.

(Report for 1901 and 1902).

9. Singapore.—Raffles Museum and Library.

Dr. R. HANITCH, PH. D., Curator.

(Report for 1902).

10. Taiping.—Perak Museum.

E. KEILICH, Acting Curator.

(Report for 1902.)

11. Trivandrum.—Trivandrum Government Museum and Gardens, Travancore.

H. S. FERGUSON, F.L.S., F.Z.S., Director.

(Report for M.E. 1077, 1901-1902.)

Australia.

12. Adelaide.—South Australian Zoological and Acclimatization Society.

ALFRED C. MINSCHIN, Director.

(Twenty-fifth Annual Report, 1902-1903.)

America.

13. New York.—New York Zoological Society.

W. T. HORNADAY, C.M.Z.S., Director.

(Bulletins, Nos 8, 9, 10 & 11).

14. Philadelphia.—Zoological Society of Philadelphia.
ARTHUR ERWIN BROWN, Secretary.
(Thirty-first Annual Report, 1902-1903.)

Africa.

15. Pretoria.—Transvaal Museum and Zoological Gardens.
Dr. J. W. B. GUNNING, Director.
(List of Additions to the Zoological Gardens, Aug.
1902 to April 1903.)
16. CAPE TOWN.—South African Museum.
W. L. SCLATER, M.A., F.Z.S., Director.
(Report for 1902).

IV. BUILDINGS.

1. **Lion House**, built 1901. This house is proving most satisfactory. Six new Turkish Oak sleeping benches for the animals were added, being paid for out of the balance of the Public Debt Commission's Grant given in 1901. Some small repairs were done to the roof and to six of the small carnivora cages.

2. **Elephant House**, built 1900. This house is also most satisfactory. The pitch-pine bars of the north interior cage were replaced by teak and paid for out of the balance of the Public Debt Commission's Grant of 1901. The north, west and south exterior walls were repainted.

3. **Tropical House**, built 1902. This house appears to answer all its requirements, the heating apparatus works well and is economical of coal. Two glass-sided tanks for water tortoises were provided by the balance of the Public Debt Commission's Grant of 1901. Three strong tables for exhibition tanks were constructed.

4. **Monkey House**.—Originally built about thirty years ago, and not intended for animals; between 1891 and 1896 reconstructed for its present purpose, the authorities in charge at that time did their best, but little money was available and old and inferior materials were employed. By October 1898 the building was in a deplorable state, roof incapable of keeping rain out, cages incapable of keeping monkeys in, it was extremely draughty, owing to the construction of cages, roof and floor, impossible to thoroughly clean or to free from rats. Since 1898 much of the carpenters' and keepers' time has been taken up by constant small repairs, but the condition of the building does not improve. In 1903 the Tanzim Department gave a grant of L.E.25 with which several repairs and small improvements were effected, enabling the building to be still used during the winter of 1903-1904.

5. **Caracol**.—The Ministry of Finance handed over to the Zoological Gardens a piece of land running the whole length of the south side of the Gardens of an area of 1 feddan, 17 kirats, 4 sahm (=1.714 feddans), or 1.779 acres, on the eastern end of which the Caracol stands. This imposing battlemented building erected as a Guard House to Giza Palace in the reign of H.H. the Khedive Ismail Pasha, and till recently used as a police station,

was handed over to the Gardens on the 1st October, 1903, it was altered and restored so that the central portion now forms the south entrance to the Zoological Gardens, and the wings will eventually give accommodation for store-rooms and work-shops.

6. New South Wall—A substantial brick wall with an artificial stone coping was built by the Tanzim Department along the southern boundary of the Gardens including the new strip of land mentioned in the last paragraph and replacing the old wooden fence, which was unsatisfactory as failing to keep out either human or four-footed trespassers.

7. Elephant Steps.—Owing to the Elephant having grown taller, the steps erected in 1900 for people wishing to ride on his back, were made nearly two feet (60 centimetres) higher, by the Tanzim Department.

8. Bear House.—The alterations carried out in 1902 have proved very satisfactory.

9. Director's House.—The interior of the Office and dining-room were repainted.

10. Hyæna House.—The western exterior cage was repaved with hard Trieste stone laid in cement.

11. African and 1899 Aviaries.—These buildings have answered their purpose satisfactorily, but as the collection of birds grows, are becoming too crowded. Three leaks appeared in the tanks of the African Aviary, which were consequently repaired.

12. Birds of Prey Cages.—A row of seven old cages in the Haremlik Garden were demolished, and an entirely new cage begun to be built on the site, with a wooden floor raised 29 inches (72 centimetres) off the ground. The interior dimensions of the new cage are approximately :—length 93 feet (28·40 metres), width 11½ feet (3·50 metres,) height 9 ½ feet (3 metres).

13. Ibex Enclosure.—The Ibex having several times broken out of their paddock; the fence, which is about 212 yards (194 metres) long was repaired and strengthened.

14. Paddocks.—Small repairs and improvements were carried out in the north-western, Central and Sekunlik Paddocks.

15. **New Cages** were built for small birds and monkeys near the South Gate and for jackals near the Lion House, and ones for oribi near the Director's House and for alligators near the Citadel Grotto were commenced.

16. **Garden Seats.**—Forty new wooden seats for visitors were put up in various parts of the Gardens.

17. **Pavements in Haremlik Garden.**—The work of repairing the marble and mosaic-work pavements was continued but makes slow progress.

18. **Paths in Selamlık Garden.**—The paths leading to the South Gate were relevelled, sanded, rolled and edged with pieces of Trieste stone set on end to form an irregular "dog tooth" pattern.

19. **Bridges.**—Four of the bridges over the Selamlık Canal were repaired and repainted, work urgently required as nothing had been done to these bridges since they were first erected rather over thirty years ago.

20. **Labels, etc.**—37 new zoological and 3 new botanical labels were painted and put up, and 20 old zoological labels repainted. Two propagating frames for the Nursery Garden, three enpboards, a collapsable travelling cage for antelopes, and two parrot stands were also made by the carpenter.

V. ANIMALS.

(i) *Number of Animals alive in Gardens.*

	6th Oct., 1898		6th Oct., 1899		6th Oct., 1900		6th Oct., 1901		6th Oct., 1902		6th Oct., 1903	
	Specimens	Species	Specimens	Species	Specimens	Species	Specimens	Species	Specimens	Species	Specimens	Species
<i>Mammals.</i>												
Primates	59	15	66	15	80	19	66	19	69	17	73	15
Carnivora	25	12	39	13	67	20	46	17	66	22	57	20
Insectivora	—	—	8	1	2	1	3	1	10	1	4	2
Chiroptera	—	—	2	1	2	1	2	2	12	2	16	3
Rodentia	—	—	4	4	16	7	6	4	25	7	21	8
Ungulata	46	17	50	14	82	20	81	18	100	25	115	24
Edentata	1	1	1	1	1	1	1	1	1	1	1	1
Marsupialia	5	3	2	2	9	6	6	4	4	3	4	3
TOTAL MAMMALS.	136	50	172	51	253	75	211	66	287	78	291	76
<i>Birds.</i>												
Passeres	7	1	55	7	51	7	64	15	79	20	123	24
Psittaci	10	6	30	11	53	17	49	20	74	24	92	28
Striges	—	—	—	—	—	—	5	1	4	1	3	1
Accipitres	16	7	18	8	26	9	45	11	48	16	33	14
Steganopodes	1	1	24	2	15	2	17	2	15	2	15	3
Herodiones	1	1	5	3	6	3	6	3	21	7	30	8
Anseres	24	8	40	11	60	14	61	16	63	13	43	10
Columbæ	30	8	30	7	50	7	45	6	60	8	81	7
Pterocletes	1	1	6	2	7	2	23	1	21	1	15	1
Gallinæ	38	11	49	11	87	10	125	11	117	11	89	10
Fulicarie	—	—	—	—	—	—	1	1	1	1	2	2
Alectorides	—	—	1	1	4	2	12	2	10	3	11	3
Limicolæ	—	—	—	—	—	—	—	—	3	2	4	2
Gaviæ	—	—	3	1	3	1	3	1	3	1	4	1
Casuarii	2	1	2	1	2	1	2	1	—	—	—	—
Struthionæ	3	2	5	1	7	1	8	2	7	2	7	2
TOTAL BIRDS.	133	47	268	66	371	76	466	93	526	112	552	116
<i>Reptiles.</i>												
Chelonia	1	1	13	7	24	8	58	10	63	10	73	18
Emydosauria	—	—	2	1	2	1	2	1	3	2	2	1
Squamata	—	—	16	6	15	8	33	9	44	9	41	11
TOTAL REPTILES.	1	1	31	14	41	17	93	20	110	21	116	30
Batrachians	—	—	2	1	5	1	—	—	—	—	—	—
GRAND TOTAL.	270	98	473	132	670	169	770	179	923	211	959	222

(ii). The following seventy-one species of birds have visited the Gardens of their own accord during the years 1899 to 1903.

1st Species found wild in Egypt.

1. Song Thrush, *Turdus musicus*.
2. Blackbird, *Turdus merula*.
3. Redstart, *Rotquilla phoeniceus*.
4. ? Black Redstart, *Rotquilla titys*.
5. Blue-throated Warbler, *Cyanecula svecica*.
6. Robin Redbreast, *Erythacus ruberula*.
7. ? Nightingale, *Luscinia luscinia*.
8. Subalpine Warbler, *Sylvia subalpina*.
9. Blackcap Warbler, *Sylvia atricapilla*.
10. Willow Warbler, *Phylloscopus trochilus*.
11. Chiffchaff Warbler, *Phylloscopus collybita*.
12. Olivaceous Warbler, *Hypolais pallida*.
13. Rufous Warbler, *Aedon galeetodes*.
14. Graceful Wren-Warbler, *Prinia gracilis*.
15. ? Nuthatch, *Sitta sp.*
16. White Wagtail, *Motacilla alba*.
17. Grey Wagtail, *Motacilla melanope*.
18. Golden Oriole, *Oriolus galbula*.
19. Masked Shrike, *Lanius nubicus*.
20. Pied Flycatcher, *Muscicapa atricapilla*.
21. ? Chimney-Swallow, *Hirundo rustica*.
22. Egyptian Chimney-Shallow, *Hirundo savignii*.
23. House-Sparrow, *Passer domesticus*.
24. Chaffinch, *Fringilla coelebs*.
25. ? Corn-Bunting, *Emberiza miliaria*.
26. Cretzschmar's Bunting, *Emberiza caesia*.
27. Short-toed Lark, *Calandrella brachydactyla*.
28. Hooded Crow, *Corvus cornix*.
29. ? Egyptian Nightjar, *Caprimulgus aegyptius*.
30. Kingfisher, *Alcedo ispida*.
31. Pied Kingfisher, *Ceryle rudis*.
32. Roller, *Coracias garrulus*.
33. Bee-eater, *Merops apiaster*.
34. Hoopoe, *Upupa epops*.
35. Southern Little Owl, *Athene glauc.*
36. Barn-Owl, *Strix flammea*.
37. Sparrow-Hawk, *Accipiter nisus*.
38. Peregrine Falcon, *Falco peregrinus*.
39. Kestrel, *Falco tinnunculus*.

40. Egyptian Kite, *Milvus aegyptius*.
41. Egyptian Vulture, *Neophron percnopterus*.
42. Pelican, *Pelecanus onocrotalus*.
43. Grey Heron, *Ardea cinerea*.
44. Purple Heron, *Ardea purpurea*.
45. Little Egret, *Ardea garzetta*.
46. Night-Heron, *Nycticorax grisens*.
47. White Stork, *Ciconia alba*.
48. Spoonbill, *Platalea leucorodia*.
49. Wild Duck, *Anas boschas*.
50. Pintail Duck, *Anas acuta*.
51. Shoveller, *Spatula clypeata*.
52. Teal, *Querquedula crecca*.
53. Tufted Duck, *Fuligula cristata*.
54. ? Red-crested Pochard, *Fuligula rapina*.
55. Pochard, *Fuligula ferina*.
56. White-eyed Duck, *Fuligula nyroca*.
57. Rock-Dove, *Columba livia*.
58. ? Turtle-Dove, *Turtur auritus*.
59. Palm Dove, *Turtur senegalensis*.
60. Water-Hen, *Gallinula chloropus*.
61. Coot, *Fulica atra*.
62. ? Demoiselle Crane, *Grus virgo*.
63. Stone-Curlew, *Edicnemus scolopace*.
64. Lapwing, *Vanellus vulgaris*.
65. Woodcock, *Scolopax rusticola*.

At least two more species of Warblers have been seen but not identified, and the European Nightjar, Osprey, Lesser Kestrel and Grey Crane are believed to have occurred. A query has been placed before nine species in the above list as although the identifications are believed to be correct they rest on less certain evidence than the majority of species enumerated.

2nd foreign species which presumably must have escaped from captivity elsewhere in Egypt.

1. Red-headed Weaver Bird, *Ploceus madagascariensis*.
2. Striated Finch, *Munia striata*.
3. Java Sparrow, *Munia oryzivora*.
4. Green Parrakeet, *Palaeornis torquata* or *P. docilis*.
5. Larger Green Parrakeet, *Palaeornis* sp. ?
6. Grey-headed Love-bird, *Agapornis cana*.

A manuscript record has been kept of the dates when each species was noted in the gardens, and of the number of individuals observed, which

in most cases are found to be increasing from year to year; the Harenulik Lake is the favourite resort of the wild fowl, 171 Shovellers have been counted there at once, and 360 Night Herons, in 1902 the largest number of Teal counted on the lake at one time was 130, in 1903 it was 171, and on the 25th February 1904, there were 283 Teal there.

The following snakes were caught in the gardens during 1903, all were small and harmless.

1. Thirteen *Glaconia cairi* (6th, 22nd and 27th Feb., 9th, 22nd [five specimens], 23rd and 26th March, 10th April and 1st May); the specimen found on the 6th February was 247 m.m. in length.
2. Two *Zamenis florulentus* (19th April and — September).
3. One *Psammophis sibilans*. (11th April).
4. Three *Tarbophis obtusus* (4th, 9th and 31st October).

(iii.) Registered additions to the Menagerie :—

	1899	1900	1901	1902	1903
Acquired by presentation	98	103	74	103	48
„ „ purchase	515	209	343	126	309
Bred in the gardens	27	31	25	64	81
Received on deposit	26	11	27	39	13
Obtained in exchange... ..	5	17	5	6	10
Total	671	371	474	338	461

Of the additions during 1903 the following should be specially mentioned:—

The fine pair of Grevy's Zebras *Equus grevyi* deposited on the 7th March by the Zoological Society of London to whom they had been presented by Lieut. Col. J. L. Harrington, C.B., C.V.O., and several additions to the collection of Egyptian birds, including the Little Bittern, Purple Coot, Corn-Crake, Lapwing, etc.

(iv). The following were bred in the Gardens during 1903 :—

1. Dusky Lemur, *Lemur fulvus*, 1 (born 6th June).
2. Northern Genet, *Genetta vulgaris*, 2 (born 27th July, died suddenly 26th October).
3. Egyptian Jackal, *Canis lupaster*, 11 (litter of 4 31st March and one of 7 21st April; none were reared).
4. Cairo Spiny Mouse, *Acomys cahirinus*, numerous.

5. Dorcas Gazelle, *Gazella dorcas*. 7 (of which 4 died before the end of the year).
 6. Arabian Gazelle, *G. arabica*. 1 (born 6th Feb. died 8th May).
 7. Ariel, *G. sommerringi*. 3.
 8. Angora Goat, *Capra hircus* var. 1.
 9. Circassian. Goat, *Capra hircus* var. 1.
 10. Ibex, *Capra nubiana* (pure-bred and hybrids) 9 (of which 2 died before end of year).
 11. Sudan Sheep, *Ovis aries* var. 2.
 12. Hedjaz Sheep, *Ovis aries* var. 4.
 13. Arui Wild Sheep, *Ovis leucis*. 1 (born 17th June, died same day).
 14. Griffon Vulture, *Gyps fulvus*. 1 (hatched 9th June, died 2nd September).
 15. Silver Pheasant, *Euplocamus nycthemurus*. 3 (hatched 1st May, one died 21st September).
 16. Laughing Dove, *Turtur risorius*. 16.
 17. Palm Dove, *Turtur senegalensis*. 11.
 18. Central African Dove, *Turtur decipiens*. 7.
- Unless otherwise stated the above were successfully reared, as were also Turkeys, Guinea Pigs, Rabbits, etc.

(v) Registered departures from the Menagerie :—

	1899	1900	1901	1902	1903
Sent away from the gardens, for various causes.	10	23	27	88	60
Disappeared (mostly small birds). ...	27	21	6	33	23
Killed by wild foxes, cats, rats, etc....	24	21	20	6	—
Accidental deaths from animals injuring themselves, or each other ...	16	10	19	16	20
Deaths from natural causes	233	194	210	196	235
Total ...	310	269	282	339	338

No important animals died during the year. The twenty accidental deaths include nine Jackal puppies eaten by their mothers, a Lion cub which choked itself eating a piece of meat, an Angora Goat which fell into a canal and was drowned, and several animals and birds which met their deaths fighting their companions in the same cages.

The disappearances include several ducks which may have been carried off by foxes or wild-cats.

The number of deaths in each month was :—

	1889	1900	1901	1902	1903
January... ..	33	15	19	26	25
February	22	15	18	14	17
March... ..	11	15	11	18	8
April	17	12	11	11	15
May	19	19	12	8	15
June	14	18	13	12	18
July	16	14	11	14	11
August	11	5	18	13	20
September	14	11	21	12	21
October	30	17	17	18	24
November	31	19	23	20	17
December	15	34	26	30	44
Total	233	194	210	196	235

Of these 235 animals there were :

- 45 monkeys.
- 9 lemurs.
- 45 other mammals.
- 98 birds.
- 38 reptiles.

Thirty-eight of the above died within one month of arriving in the Gardens, and twenty-seven between one and three months of their arrival.

Six of the nine lemurs died of dysentery (ulcerative colitis) between the 11th January and 26th February, one died from the result of an accident, one apparently from old age and the remaining one from unknown causes.

Several of the monkeys died of dysentery about the same time as this disease appeared among the lemurs ; three died of tuberculosis ; others of pneumonia and severe constipation, but as usual in many cases it was impossible to determine the cause of death, all the organs appearing healthy.

Dr. G. Elliot Smith, Cairo School of Medicine, kindly made postmortem examinations of a large number of the animals that died.

(vi) A list of the species and varieties of Animals which have been exhibited alive in the Egyptian Government's Zoological Gardens at Giza, from 6th October 1898 to 4th March 1904.

Those species which occur wild in, or are domesticated in, Africa and its adjacent islands, including Madagascar, are marked with an asterisk.

Class Mammalia.

ORDER PRIMATES.

Family Simiidae.

1. *Simia satyrus* Linnæus Mias, or Orang Utan.

Family Cercopithecidae.

2. *Semnopithecus entellus* (Dufresne) ... Langúr, or Hanimán, Monkey.
3. .. *obscurus*, Reid Dusky Leaf-Monkey.
4. .. *cephalopterus* (Zimmermann) Purple-faced Monkey.
5. *Nasalis larvatus* (Wurm) Proboscis Monkey.
- * 6. *Cercocebus fuliginosus*, E. Geoffroy... Sooty Mangabey.
- * 7. *Cercopithecus athiops* (Linnæus) ... Grivet Monkey.
- * 8. .. *pygerythrus*, F. Cuvier? Vervet Monkey?
- * 9. .. *patas* (Schreber)... .. Patas Monkey.
- * 10. .. *albigularis*, Sykes ... Sykes's Monkey.
11. *Macacus sinicus* (Linnæus) Bonnet Monkey.
12. .. *pileatus* (Shaw) Toque Monkey.
13. .. *cynomolgus* (Linnæus) ... Kra, or Macaque Monkey.
14. .. *nemestrinus* (Linnæus) ... Broh, or Pig-tailed Monkey.
15. .. *rhesus* (Audebert) Bandar, or Bengal Monkey.
16. .. *maurus*, F. Cuvier Moor Macaque Monkey.
- * 17. .. *inuus* (Linnæus)... .. Barbary, or Rock Ape.
18. *Cynopithecus niger* (Desmarest) ... Black Ape of Celebes.
- * 19. *Papio hamadryas* (Linnæus) Arabian, or Sacred Baboon.
- * 20. .. *anubis* (Fischer) Anubis Baboon.
- * 21. .. *cynocephalus* (Linnæus)... .. Yellow Baboon.

Family Cebidae.

22. *Cebus hypoleucus* (Humboldt) White-throated Capuchin
Monkey.

Family Lemuridae.

- * 23. *Lemur varius*, Isidore Geoffroy ... Ruffed Lemur.
- * 24. .. *mararo* (Linnæus)... .. Black Lemur.
- * 25. .. *nigerrimus*, Selater Very Black Lemur.
- * 26. .. *fulvus*, E. Geoffroy Dusky Lemur.
- * 27. .. *coronatus*, Gray Crowned Lemur.
- * 28. .. *catta*, Linnæus Ring-tailed Lemur.
29. *Nycticebus tardigradus* (Linnæus) ... Slow Loris.
30. *Loris gracilis*, E. Geoffroy Slender Loris.

ORDER CARNIVORA.

Family Felidæ.

- *31. *Felis leo*, Linnæus Lion.
- 32. „ *tigris*, Linnæus Tiger.
- *33. „ *pardus*, Linnæus Leopard, or Panther.
- *34. „ *serval*, Schreber... .. Serval.
- *35. „ *chaus*, Gùlden-städt Jungle Cat.
- *36. „ *libyca*, Meyer Fettered Cat.
- *37. „ *domestica*, Brisson The Cat.
- *38. „ *caracal*, Gùldenstädt... .. Caracal.
- *39. *Cynelurus jubatus* (Erxleben)... .. Chita, or Hunting Leopard.

Family Viverridæ.

- *40. *Viverra civetta* (Schreber) African Civet-Cat.
- *41. „ *malaccensis*, J. F. Gmelin Rasse Civet-Cat.
- *42. *Genetta vulgaris* (Lesson)... .. Northern Genet.
- *43. „ *senegalensis* (Fischer)... .. Pale Genet.
- 44. *Paradoxurus hermaphroditus* (Pallas) Malay Palm Civet-Cat.
- *45. *Herpestes ichneumon* (Linnæus) Egyptian Mongoo-e.
- *46. *Crossarchus zebra*, Rüppell Zebra Mongooose.

Family Hyænidæ.

- *47. *Hyæna crocuta* (Erxleben) Spotted Hyæna.
- *48. „ *striata*, Zimmermann Striped Hyæna.

Family Canidæ.

- *49. *Canis familiaris*, Linnæus The Dog.
- *50. „ *lupaster*, Hemprich & Ehrenberg Egyptian Jackal.
- *51. „ *anthus*, F. Cuvier, *var. soudanicus*, Thomas Sudanese Jackal.
- *52. „ *mesomelas*, Schreber Black-backed Jackal.
- *53. „ *vulpes*, Linnæus The Fox.
- *54. „ *famelicus*, Cretzschmar Sand Fox.
- *55. „ *zerda*, Zimmermann Fennec Fox.

Family Mustelidæ.

- 56. *Mustela putorius*, Linnæus, *var. furo*, Linnæus Ferret.
- *57. „ *vulgaris*, Erxleben, *var. africana*, Desmarest Egyptian Weasel.
- *58. *Ictonyx libyca* (Hemprich & Ehrenberg) Libyan Striped-Weasel.
- 59. *Meles taxus* (Boddaert) Badger.

Family Ursidæ.

60. *Ursus arctos*, Linnæus Brown Bear.
 61. " " *var. syriacus*.
 Hemprich & Ehrenberg Syrian Bear.
 62. " " *var. piscator*,
 Pucheran? Fishing Bear ?
 63. .. *malayanus*, Raffles Malay, Sun or Honey Bear.
 64. *Melursus ursinus* (Shaw) Sloth Bear.

ORDER INSECTIVORA.

Family Erinaceidæ.

- *65. *Erinaceus auritus*, S. G. Gmelin ... Long-eared Hedgehog.

Family Soricidæ.

- *66. *Crocidura oliveri* (Lesson) Olivier's Shrew.

ORDER CHIROPTERA.

Family Pteropodidæ.

- *67. *Rousettus ægyptiacus* (E. Geoffroy)... Egyptian Fruit-Bat.
 *68. .. *collaris* (Illiger) Collared Fruit-Bat.

Family Rhinolophidæ.

- *69. *Rhinolophus antinori*, Dobson Antinori's Horseshoe Bat.

Family Nycteridæ.

- *70. *Nycteris thebaica*, E. Geoffroy... .. Theban Long-eared Bat.

Family Vespertilionidæ.

- *71. *Otonycteris hemprichi*, Peters Hemprich's Long-eared Bat.
 *72. *Pipistrellus kuhli* (Natterer) Kuhl's Pipistrelle Bat.

Family Emballonuridæ.

- *73. *Taphozous nudiventris*, Cretzschmar. Sheath-tailed Bat.
 *74. *Rhinopoma microphyllum* (Brünnich). Long-tailed Bat.
 *75. *Nyctinomus ægyptiacus*, E. Geoffroy. Wrinkled-lipped Bat.

ORDER RODENTIA.

Family Sciuridæ.

76. *Sciurus prevosti*, Desmarest Raffles's Squirrel.

Family Muridæ.

- *77. *Gerbillus agyptius*, Desmarest... .. Lesser Egyptian Gerbille.
 *78. „ *pyramidum*, Isidore Geoffroy ... Greater Egyptian Gerbille.
 *79. *Pachyuromys dupresi*, Lataste... .. Fat-tailed Gerbille.
 *80. *Mus rattus*, Linnæus... .. The Rat.
 *81. „ *norvegicus*, Erxleben Norway Rat.
 *82. „ *musculus*, Linnæus... .. The Mouse.
 *83. „ *niloticus* (E. Geoffroy) Nile Rat.
 *84. *Acromys cahirinus* (E. Geoffroy) ... Cairo Spiny Mouse.

Family Dipodidæ.

- *85. *Dipus jaculus* (Linnæus) Lesser Egyptian Jerboa.
 *86. „ *gerboa*, Olivier Greater Egyptian Jerboa.

Family Hystricidæ.

- *87. *Hystrix cristata*, Linnæus... .. Crested Porcupine.
 88. „ *leucura*, Sykes Indian Porcupine.
 89. „ *longicauda*, Marsden Malay Porcupine.

Family Caviidæ.

90. *Cavia porcellus* (Linnæus) Domestic Cavy, Guinea-Pig.

Family Leporidæ.

- *91. *Lepus cuniculus*, Linnæus... .. The Rabbit.
 *92. „ *agyptius*, Desmarest? Egyptian Hare.

ORDER UNGULATA.

Family Procaviidæ.

- *93. *Procapra sp. incert.* Egyptian Hyrax.

Family Elephantidæ.

94. *Elephas indicus*, Cuvier Indian Elephant.

Family Equidæ.

- *95. *Equus caballus*, Linnæus... .. The Horse.
 *96. „ *asinus*, Linnæus... .. The Ass, or Donkey.
 *97. „ „ „ *var. africanus*
 Fitzinger African Wild Donkey.
 *98. *Equus grevyi*, Milne-Edwards... .. Grevy's Zebra.

Family Bovidæ.

- * 99. *Bos taurus* Linnæus... .. The Ox.
 100. „ *indicus* Indian Ox, or Zebu.
 *101. „ „ „ var.? ... Nuer Ox.
 *102. „ *babulus* Linnæus ... The Buffalo.
 *103. *Ourebia montana* (Rüppell) ... Oribi.
 *104. *Cobus defassa* (Rüppell)... .. Waterbuck.
 *105. *Gazella dorcas* (Linnæus) ... Dorcas Gazelle.
 *106. „ „ „ var. *isabella*,
 Gray Isabella Gazelle.
 *107. *Gazella ptilonura* (Heuglin)? ... Von Heuglin's Gazelle?
 *108. „ *rufifrons*, Gray ... Korin Gazelle.
 109. „ *arabica* (Heimrich & Ehrenberg) ... Arabian Gazelle.
 110. „ *subgutturosa* (Güldenstädt)... Persian Gazelle.
 *111. „ *sammerringi* (Cretzschmar). Arial, or Aoul.
 112. *Antelope cervicapra* (Linnæus). ... Indian Antelope, or Black Buck.
 *113. *Hippotragus equinus* (Desmarest)... Roan Antelope.
 *114. *Oryx leucomys* (Pallas) ... Sabre-horned Antelope.
 *115. *Addax nasomaculatus* De Blainville) Addax.
 *116. *Strepsiceros kudu* Gray ... Greater Kudu.
 *117. *Capra hircus* Linnæus var.? ... Egyptian Goat.
 *118. „ „ „ ... Sudanese Goat.
 119. „ „ „ ... Bornean Goat.?
 120. „ „ „ ... Angora Goat.
 121. „ „ „ ... Circassian Goat.
 *122. *Capra nubiana* F. Cuvier ... Nubian Ibex.
 *123. *Ovis aries* Linnæus var.? ... Egyptian "Bahrowi" Sheep.
 *124. „ „ „ ... Sudanese Roman-nosed Sheep.
 *125. „ „ „ ... Hedjaz Black-headed Sheep.
 *126. „ „ „ ... Wau Short-tailed Sheep.
 *127. *Ovis levia* (Pallas) ... Arui, or Barbary Wild Sheep.

Family Giraffidæ.

- *128. *Giraffa camelopardalis* (Linnæus).. Giraffe.

Family Cervidæ.

129. *Cervus elaphus* (Linnæus) var. *maral*
 Gray Persian Red Deer.
 130. *Cervus unicolor* Bechstein ... Sambar, or Rusa Deer.
 131. „ *axis* Erxleben ... Chital, or Spotted Deer.
 *132. „ *dama* Linnæus ... Fallow Deer.

Family Tragulidæ.

133. *Tragulus meminna* (Erxleben) ... Indian Mouse Deer.

Family Camelidæ.

134. *Lama huanacos* (Mol.) ... Huanaco, or Wild Lama.
*135. *Camelus dromedarius* Linnæus ... Arabian Camel.
136. „ *bactrianus* Linnæus... Bactrian Camel.

Family Suidæ.

- *137. *Phacochoerus africanus* (Gmelin) ... (Elian's) Wart Hog.
138. *Sus cristatus* Wagner ... Asiatic Wild Swine.
139. *Babirusa aljurus* Lesson... Babirusa.

ORDER EDENTATA.

Family Dasypodidæ.

140. *Dasypus villosus* Desmarest ... Hairy Armadillo.

Family Orycteropodidæ.

- *141. *Orycteropus arthiopicus* Sundevall... Ethiopian Ant-Bear.

ORDER MARSUPIALIA.

Family Macropodidæ.

142. *Macropus giganteus* Shaw ... Great Kangaroo.
143. „ *melanops* Gould ... Black-faced Kangaroo.
144. „ *robustus* Gould... Wallaroo.
145. „ *ualabatust* (Less.and Garn.) Black-tailed Wallaby.
146. „ *derbianus* (Gray) ... Derbian Wallaby.
147. *Petrogale penicillata* Gray ... Brush-tailed Wallaby.

Family Phalangeridæ.

148. *Trichosurus vulpecula* (Kerr)... Australian Opossum or
Phalanger.

Family Phascolomyidæ.

149. *Phascolomys mitchelli* Owen ... Wombat.

Class Aves.

ORDER PASSERES.

Family Turdidæ.

- * 1. *Turdus musicus* Linnæus ... Song-Thrush.

- * 2. *Monticola saratilis* (Linnæus) Rock Thrush.
- * 3. *Ruticilla phœnicurus* (Linnæus) Red-tart.
- * 4. *Daulias lusciniæ* (Linnæus) Nightingale.

Family Motacillidæ.

- * 5. *Motacilla alba*, Linnæus White Wagtail.
- * 6. *Anthus trivialis* (Linnæus) Tree-Pipit.

Family Pycnonotidæ.

- * 7. *Pycnonotus xanthopygus* (Hemprich & Ehrenberg) Syrian Bulbul.

Family Muscicapidæ.

- * 8. *Muscicapa collaris*, Bechstein White-collared Flycatcher.

Family Ploceidæ.

- 9. *Estrellda amandava* (Linnæus) Amaduvade Finch.
- *10. „ *cinerea* (Vieillot)... .. Grey Waxbill.
- *11. „ *phœnicotis*, Swainson Cordon Bleu, or Crimson-eared Waxbill.
- *12. „ *senegala* (Linnæus) *var.*
 brunneiceps (Sharpe) Fire Finch.
- *13. *Munia nana* (Pucheran) Dwarf Finch.
- *14. „ *ultramarina* (J. F. Gmelin) Ultramarine Finch.
- *15. „ *fasciata* (J. F. Gmelin) Cut-throat Finch.
- 16. „ *punctulata* (Linnæus) Nutmeg Bird, or Spice Finch.
- 17. „ *malacca* (Linnæus)... .. Three-coloured Finch.
- 18. „ *atricapilla* (Vieillot) Black-headed Chestnut Finch.
- 19. „ *maja* (Linnæus) White-headed Finch.
- 20. „ *striata* (Linnæus) Striated Finch.
- 21. „ *“domestica”* Bengalee Finch.
- 22. „ *malabarica* (Linnæus) Silver-bill Finch.
- 23. „ *oryzivora* (Linnæus) Java Sparrow.
- 24. *Erythrura prasina* (Sparrman) Fire-tailed Finch.
- *25. *Vidua paradisea* (Linnæus) Paradise Whydah-bird.
- *26. „ *principalis* (Linnæus) Pin-tailed Whydah-bird.
- *27. *Ploceus madagascariensis* (Linnæus) Red-headed Weaver Bird.
- 28. „ *baya*, Blyth Yellow-headed Weaver Bird.

Family Fringillidæ.

- 29. *Paroaria cucullata* (Latham) Red-crested Cardinal.
- *30. *Passer domesticus* (Linnæus) House Sparrow.
- *31. *Coccothraustes vulgaris*, Pallas... .. Hawfinch.

Family Cacatuidæ.

- | | | |
|-----|--|--------------------------------------|
| 55. | <i>Cacatua galerita</i> (Latham) | Greater Sulphur-crested
Cockatoo. |
| 56. | .. <i>sulphurea</i> (J. F. Gmelin) ... | Lesser Sulphur-crested
Cockatoo. |
| 57. | .. <i>leadbeateri</i> (Vigors) | Leadbeater's Cockatoo. |
| 58. | .. <i>alba</i> (P. L. S. Müller)... .. | Greater White-crested
Cockatoo. |
| 59. | .. <i>moluccensis</i> (J. F. Gmelin).. | Rose-crested Cockatoo. |
| 60. | .. <i>gymnopsis</i> , Sclater | Bare-eyed Cockatoo. |
| 61. | .. <i>ducorsii</i> , Hombr. & Jacq. . . | Ducorp's Cockatoo. |
| 62. | .. <i>roseicapilla</i> , Vieillot | Rose-eate Cockatoo. |
| 63. | <i>Leucotis masica</i> (Temminck) | Slender-billed Cockatoo. |
| 64. | <i>Calopsittacus nova-hollandia</i> (J.F.Gmelin) | Cockateel. |

Family Psittacidæ.

- | | | |
|------|---|----------------------------------|
| 65. | <i>Ara ararama</i> (Linnaeus) | Blue-and-Yellow Macaw. |
| 66. | .. <i>macao</i> (Linnaeus) | Red-and-Blue Macaw. |
| 67. | <i>Conurus nanday</i> (Desmarest) | Black-headed Conure. |
| 68. | <i>Chrysotis astita</i> (Linnaeus) | Blue-fronted Amazon-Parrot. |
| 69. | .. <i>ochrocephala</i> (J.F.Gmelin) | Yellow-fronted
Amazon-Parrot. |
| 70. | .. <i>rhodocorytha</i> , Salvadori ... | Red-topped Amazon-Parrot. |
| 71. | .. <i>salvini</i> , Salvadori | Salvin's Amazon-Parrot. |
| *72. | <i>Psittacus erithacus</i> , Linnaeus | Gray-Parrot. |
| *73. | <i>Coracopsis vasa</i> (Linnaeus) | Greater Vasa Parrot. |
| 74. | <i>Eclectus roratus</i> (P. L. S. Müller) ... | Grand Noble-Parrot. |
| 75. | .. <i>westermanni</i> (Bonaparte) ... | Westerman's Noble-Parrot. |
| 76. | <i>Tanygnathus megalorhynchus</i> (Boddaert) | Great-billed Parrot. |
| 77. | <i>Paluornis torquata</i> (Boddaert)... .. | Ring-necked Parrakeet. |
| *78. | .. <i>docilis</i> (Vieillot) | Rose-ringed Parrakeet. |
| 79. | .. <i>cycnocephala</i> (Linnaeus) ... | Blossom-headed Parrakeet. |
| 80. | .. <i>rosa</i> (Boddaert)... .. | Rosy Parrakeet. |
| 81. | .. <i>fasciata</i> (P. L. S. Müller)... | Banded Parrakeet. |
| 82. | .. <i>eupatria</i> (Linnaeus) | Large Ceyloneſe Parrakeet. |
| 83. | .. <i>indoburmanica</i> , Hume ... | Large Burmese Parrakeet. |
| 84. | <i>Aprosmictus cyanopygius</i> (Vieillot)... | King Parrakeet. |
| *85. | <i>Agapornis cana</i> (J. F. Gmelin) ... | Grey-headed Love-bird. |
| *86. | .. <i>roseicollis</i> (Vieillot)... .. | Rosy-faced Love-bird. |
| 87. | <i>Platyercus erimius</i> (Shaw) | Rosella Parrakeet. |
| 88. | .. <i>barnardi</i> (Latham)... .. | Barnard's Parrakeet. |
| 89. | .. <i>multicolor</i> (Temminck) ... | Many-coloured Parakeet. |
| 90. | <i>Melopsittacus undulatus</i> (Shaw) ... | Budgerigar. |

ORDER STRIGES.

Family Strigidæ.

- * 91. *Strix flammea* Linnæus Barn-Owl.

Family Asionidæ.

- * 92. *Bubo ascalaphus* (Savigny) Egyptian Eagle-Owl.
 * 93. *Athene glauc* (Savigny) Southern Little Owl.

ORDER ACCIPITRES.

Family Falconidæ.

- * 94. *Pandion haliaëtus* (Linnæus) Osprey.
 * 95. *Circus æruginosus* (Linnæus) Marsh-Harrier.
 * 96. „ *swainsoni* Smith Pallid Harrier.
 * 97. *Buteo desertorum* (Daudin) African Buzzard.
 * 98. „ *ferox* (S. G. Gmelin) Long-legged Buzzard.
 * 99. *Haliaëtus albicilla* (Linnæus) White-tailed Eagle.
 *100. *Aquila heliaca* Savigny Imperial Eagle.
 *101. „ *rapax* (Temminck) Tawny Eagle.
 *102. „ *maculata* (J. F. Gmelin) Spotted Eagle.
 *103. *Hieraetus fasciatus* (Vieillot) Bonelli's Eagle.
 *104. *Accipiter nisus* (Linnæus) Sparrow-Hawk.
 *105. *Falco peregrinus* Tun-stall Peregrine Falcon.
 *106. „ *feldeggii* Schlegel Lanner Falcon.
 *107. „ *vespertinus* Linnæus Red-legged Falcon.
 *108. „ *tinnunculus* Linnæus Kestrel.
 *109. „ *ceenchris* Naumann Lesser Kestrel.
 *110. *Milvus migrans* (Boddaert) Black Kite.
 *111. „ *egyptius* (J. F. Gmelin) Egyptian Kite.
 *112. *Vultur monachus* Linnæus Cinereous Vulture.
 *113. „ *auricularis* Daudin Sociable Vulture.
 *114. *Gyps fulvus* (J. F. Gmelin) Griffon Vulture.
 *115. „ *rueppelli* (Brehm) Rüppell's Vulture.
 *116. *Neophron percnopterus* (Linnæus) Egyptian Vulture.

Family Serpentariidæ.

- *117. *Serpentarius gambiensis* Ogilby Northern Secretary Bird.

ORDER STEGANOPODES.

Family Pelecanidæ.

- *118. *Pelecanus onocrotalus* Linnæus ... White Pelican.
- *119. .. *crispus* Bruch. Dalmatian Pelican.
- *120. .. *rufescens* J. F. Gmelin ... Red-backed Pelican.

Family Phalacrocoracidæ.

- *121. *Phalacrocorax graculus* Linnæus ... Shag, or Crested Cormorant.

ORDER HERODIONES.

Family Ardeidæ.

- *122. *Ardea cinerea* Linnæus Grey Heron.
- *123. .. *purpurea* Linnæus Purple Heron.
- *124. .. *goliath* Cretzschmar Goliath Heron.
- *125. .. *ibis* Linnæus Buff-backed Heron.
- *126. *Ardetta minuta* (Linnæus) Little Bittern.
- *127. *Nycticorax griseus* (Linnæus) Night-Heron.

Family Balaenicipitidæ.

- *128. *Balaeniceps rex* Gould Shoebill.

Family Ciconiidæ.

- *129. *Ciconia alba* Bechstein White Stork.
- *130. *Leptoptilus crumeniferus* (Cuvier) ... Marabou Stork.

ORDER ANSERES.

Family Phœnicopteridæ.

- *131. *Phœnicopterus roseus* Pallas Flamingo.

Family Anatidæ.

- *132. *Cygnus olor* (J. F. Gmelin) Mute Swan.
- 133. .. *atratus* Latham Black Swan.
- *134. *Plectropterus rueppelli* Selater... .. Rüppell's Spur-winged Goose.
- *135. *Cairina moschata* (Linnæus) Muscovy Duck.
- 136. *Æe sponsa* (Linnæus) Summer Duck.
- 137. .. *galericulata* (Linnæus) Mandarin Duck.
- *138. *Dendrocygna ridgata* (Linnæus) ... White-faced Tree-Duck.
- *139. *Chenalopee aegyptiacus* (Linnæus) ... Egyptian Goose.

- *140. *Tadorna cornuta* (S. G. Gmelin) ... Burrow Sheldrake.
- *141. „ *casarca* (Linnaeus) ... Ruddy Sheldrake.
- *142. *Anas boschas* Linnaeus ... Wild Duck, or Mallard.
- *143. „ *strepera* Linnaeus ... Gadwall.
- *144. „ *penelope* Linnaeus ... Wigeon.
- *145. „ *acuta* Linnaeus... Pintail Duck.
- *146. *Querquedula crecca* (Linnaeus)... The Teal.
- *147. *Spatula clypeata* (Linnaeus) ... Shoveller.
- *148. *Fuligula cristata* (Leach) ... Tufted Duck.
- *149. „ *rufo* (Pallas) ... Red-crested Pochard.
- *150. „ *ferina* (Linnaeus) ... Pochard, or Dun-Bird.
- *151. *Erismatura leucocephala* (Scopoli)... White-headed Duck.

ORDER COLUMBÆ.

Family Columbidae.

- 152. *Columba livia* Brisson, *var. domestica*? Fantail Pigeon.
- *153. „ „ „ ? Feather-footed Pigeon.
- *154. *Turtur risorius* (Linnaeus) ... Barbary Turtle-Dove.
- *155. „ *vinaceus* (J. F. Gmelin) ... Vinaceous Turtle Dove.
- *156. „ *deci piens* Finsch and Hartl ... Central African Dove.
- *157. „ *senegalensis* (Linnaeus) ... Palm Dove.
- 158. *Geopelia striata* (Linnaeus) ... Barred Dove.
- 159. „ *cuneata* (Latham) ... Graceful Ground-Dove.
- *160. *Œna capensis* (Linnaeus) ... Cape Dove.
- 161. *Chalcophaps indica* (Linnaeus)... Green-winged Dove.
- 162. *Ocyphaps lophotes* (Temminck) ... Crested Pigeon.
- 163. *Phlogoenas luzonica* (Scopoli) ... Blood-breasted Pigeon.
- 164. *Caloenas nicobarica* (Linnaeus)... Nicobar Pigeon.

ORDER PTEROCLETES.

Family Pteroclidæ.

- *165. *Pterocles exustus* (Temminck)... Singed Sand-Grouse.
- *166. „ *senegallus* (Linnaeus) ... Spotted Sand-Grouse.

ORDER GALLINÆ.

Family Phasianidae.

- 167. *Francolinus vulgaris* Stephens ... Black Partridge, or Francolin.
- *168. „ *erckeli* (Rüppell)... Erckel's Francolin.
- *169. *Coturnix communis* Bonnaterre ... The Quail.

- | | | | |
|-------|---|--------|---------------------------|
| 170. | <i>Callipepla californica</i> (Shaw) | ... | Californian Quail. |
| 171. | <i>Cucubis chukar</i> (Gray) | ... .. | Chukar Partridge. |
| *172. | <i>Ammodramus hegi</i> (Temminck) | ... | Hey's Partridge |
| 173. | <i>Phasianus colchicus</i> , Linnaeus, <i>var. alba</i> . | | White Pheasant. |
| 174. | .. <i>reevesi</i> , Gray | ... .. | Bar-tailed Pheasant. |
| 175. | .. <i>elliotti</i> , Swinhoe | ... .. | Elliot's Pheasant. |
| 176. | <i>Thaumalea amherstii</i> (Leadb.) | ... | Lady Amherst's Pheasant. |
| 177. | <i>Euplocamus nycthemerus</i> (Linnaeus). | | Silver Pheasant. |
| 178. | <i>Pavo cristatus</i> , Linnaeus | ... .. | Crested Peafowl. |
| 179. | <i>var. alb.</i> | ... | White Peafowl. |
| *180. | <i>Meleagris gallopavo</i> , Linnaeus, <i>var. dom.</i> | | Black Turkey. |
| *181. | <i>var. alb.</i> | | White Turkey. |
| *182. | <i>Numida meleagris</i> (Linnaeus)... | ... | West African Guinea-fowl. |
| *183. | .. <i>ptilorhynchos</i> , Lichtenstein. | | Abyssinian Guinea-fowl. |

ORDER FULICARÆ.

Family Rallidæ.

- | | | | |
|-------|--|--------|---------------------------|
| *184. | <i>Porzana maruetta</i> (Leach) | ... .. | Spotted Crake. |
| *185. | .. <i>parva</i> (Scopoli)... | ... .. | Little Crake. |
| *186. | <i>Crex pratensis</i> , Bechstein | ... .. | Land-Rail, or Corn-Crake. |
| *187. | <i>Porphyrio madagascariensis</i> (Latham) | | Green-backed Purple Coot. |
| *188. | <i>Fulica atra</i> , Linnaeus | ... .. | The Coot. |

ORDER ALLECTORIDES.

Family Gruidæ.

- | | | | |
|-------|--------------------------------------|--------|-------------------|
| *189. | <i>Grus communis</i> , Bechstein | ... .. | Grey Crane. |
| *190. | .. <i>virgo</i> (Linnaeus) | ... .. | Demoiselle Crane. |
| *191. | <i>Balearica pavonina</i> (Linnaeus) | ... | Crowned Crane. |

ORDER LIMICOLÆ.

Family Œdionemidæ.

- | | | | |
|-------|---|--|----------------------------------|
| *192. | <i>Œdionemus scolopus</i> (S.G. Gmelin) | | Norfolk Plover, or Stone-Curlew. |
|-------|---|--|----------------------------------|

Family Charadriidæ.

- | | | | |
|-------|--|--------|----------------------|
| *193. | <i>Vanellus vulgaris</i> , Bechstein | ... .. | Lapwing. |
| *194. | <i>Hoplopterus spinosus</i> (Linnaeus) | ... | Spur-winged Plover. |
| *195. | <i>Gallinago gallinula</i> (Linnaeus) | ... | Jack-Snipe. |
| *196. | <i>Limosa belgica</i> (J. F. Gmelin) | ... | Black-tailed Godwit. |

ORDER GAVIÆ.

Family Laridæ.

- *197. *Larus fuscus*, Linnaeus Lesser Black-backed Gull.

ORDER CASUARIÆ.

Family Casuariidæ.

198. *Dromæus nova-hollandiæ*, Vieillot Emu.

ORDER STRUTHIONES.

Family Struthionidæ.

- *199. *Struthio camelus*, Linnaeus The Ostrich.

- *200. .. *molybdophanes*, Reichenow... .. Somali Ostrich.

Family Rheidæ.

201. *Rhea americana* (Vieillot) Rhea.

Class Reptilia.

ORDER CHELONIA.

Family Testudinidæ.

1. *Damonia subtrijuga* (Schlegel and Müller). Siamese Terrapin.
2. .. *reevesi* (Gray) Reeves's Terrapin.
3. *var. unicolor* Gray?... .. Black-headed Terrapin?
4. *Bellia crassicollis* Gray Black, or Thick-necked Terrapin.
- * 5. *Emys orbicularis* (Linnaeus) Pond Tortoise.
6. *Cistudo carolina* (Linnaeus) American Box-Tortoise.
7. *Nicoria trijuga* (Schweigg.) Ceylonese Terrapin.
8. *Cyclemys platynota*, Gray... .. Flat-backed Terrapin.
9. .. *dhori* (Gray) Oldham's Terrapin.
10. .. *amboinensis* (Daud.)... .. Amboina Box-Tortoise.
11. *Geoemyda spinosa*, Gray Spinous Terrapin.
12. *Testudo tabulata* Walbaum Brazilian Tortoise.
13. .. *emys*, Schlegel and Müller... .. Upland Tortois .
- * 14. .. *calcarata*, Schneid. Spurred, or Grooved Tortoise.
- * 15. .. *pardalis*, Bell Leopard Tortoise.
- * 16. .. *radiata*, Shaw Radiated Tortoise.
- * 17. .. *elephantina*, Dum. and Bibr. Elephantine Tortoise.
18. .. *elongata*, Blyth Burmese Tortoise.
19. .. *marginata*, Schoepff. Margined Tortoise.
- * 20. .. *leithi*, Günther Leith's Tortoise.
- * 21. .. *ibera*, Pallas... .. Algerian Tortoise.

Family Cheloniidae.

- *22. *Chelone mydas* (Linnaeus) Green Turtle.
 *23. *Thalassochelys caretta* (Linnaeus) ... Loggerhead Turtle.

Family Pelomedusidae.

- *24. *Sternotherus adansonii* (Schweigg.) ... Adanson's Terrapin.

Family Chelydidae.

25. *Chelodina longicollis* (Shaw) Long-necked Tortoise.

Family Trionychidae.

- *26. *Trionyx triunguis* (Forskäl) Nilotic Soft Turtle.

ORDER CROCODYLIA.

Family Crocodilidae.

- *27. *Crocodilus niloticus*, Laur. Nilotic Crocodile.
 28. „ *porosus*, Schneid. East Indian Crocodile.
 29. *Alligator mississippiensis* (Daud.) ... Alligator.

ORDER SQUAMATA.

Family Geckonidae.

- *30. *Ptyodactylus hasselquisti* (Dumndorff). Fan-footed Gecko.
 *31. *Hemidactylus turcicus* (Linnaeus) ... Turkish Gecko.
 *32. *Tarentola annularis* (Isidore Geoffroy) Egyptian Gecko.

Family Agamidae.

- *33. *Agama mutabilis* Merrem Judge of the Desert.
 *34. „ *pallida* Reuss.... .. „ „ „ „
 *35. „ *stellio* (Linnaeus) Starred Lizard.
 *36. *Uromastix aegyptius* (Hasselq. & Linn.) Dab-Lizard.

Family Iguanidae.

37. *Phrynosoma cornutum* (Harlan) ... Horned Lizard.

Family Varanidae.

- *38. *Varanus griseus* (Daud.) Desert Waran-Lizard.
 *39. „ *niloticus* (Hasselq. & Linn.).. Nilotic Waran-Lizard.

Family Lacertidae.

40. *Lacerta viridis* (Laur.) Green Lizard.
 *41. *Acanthodactylus boskianus* (Daud.)...
 *42. „ *scutellatus* (Aud.)... Scutellated Lizard.
 *43. *Eremias rubropunctata* (Lichtenstein) Red-spotted Lizard.

Family Scincidae.

- *44. *Mabuya quinquetaeniata* (Lichtenstein) Blue-tailed Skink.
 *45. *Eumeces schneideri* (Daud.) Schneider's Skink.
 *46. *Scincus officinalis* Laur. The Skink.
 *47. *Chalcides ocellatus* (Forskäl) Ocellated Sand-Skink.
 *48. „ *sepioides* (Andouin) Andouin's Sand-Skink.

Family Chameleontidae.

- *49. *Chamaeleon vulgaris*, Daud. The Chameleon.
 *50. .. *basiliscus*, Cope Basilisk Chameleon.

Family Glauconidae.

- *51. *Glauconia caïri* (Dum. and Bibr.) ... Cairo Earth-snake.

Family Boidea.

52. *Boa constrictor* Linnaeus Boa Constrictor.
 *53. *Eryx jaculus* (Hasselq and Linnaeus) Egyptian Sand-Boa.

Family Colubridae.

- *54. *Zamenis florulentus* (Is. Geoffroy) ... Flowered Snake.
 *55. .. *diadema* (Schlegel) Clifford's Snake.
 *56. *Lytorhynchus diadema* (Dum. and Bibr.).. Sand-Snake.
 *57. *Tarhophis obtusus* (Reuss.) Blunt-nosed Snake.
 *58. *Coelopeltis monspessulana* (Hermann.) Lacertine Snake.
 *59. .. *moïensis* (Reuss.) Moila Snake.
 *60. *Psammophis schokari* (Forskäl) ... Schokari Sand-Snake.
 *61. .. *sibilans* (Linnaeus) ... Hissing Sand-Snake.
 *62. *Macroprotodon cucullatus* (Is. Geoffroy). Hooded Snake.
 *63. *Naja hûie* (Hasselq and Linnaeus) ... Egyptian Cobra.

Family Viperidae.

- *64. *Cerastes vipera* (Hasselq & Linnaeus) Cerastes Viper.
 *65. .. *cornutus* (Hasselq & Linnaeus)... Horned Cerastes Viper

Class Batrachia.

ORDER ECAUDATA.

Family Ranidae.

- * 1. *Rana matsareniensis*, (Dum. & Bibr.).. Frog.

Family Bufonidae.

- * 2. *Bufo regularis*, Reuss... ... Square-marked Toad.

Family Hylidae.

- * 3. *Hyla arborea* (Linnaeus)... ... Tree-Frog.

ORDER CAUDATA.

Family Salamandridae.

4. *Molge marmorata* (Latr.) Marbled Newt.
 5. .. *cristata* (Laur.) Crested Newt.

VII. ACCOUNTS.

Table of Receipts and Expenditure, under the various heads, during 1903.

RECEIPTS.		L.E.	Mill.	EXPENDITURE.		L.E.	Mill.
1. Balance Credit from 1902	...	191	386	1. Salaries	...	1,835	912
2. Government contribution for 1903...	...	1,500	—	2. Keepers' clothing	...	52	025
3. Grant from Giza-Gezira Gardens Budget.	...	1,619	—	3. Feeding, bedding and fuel for animals	...	1,315	505
4. Grant from P.W.D. for repairs	...	25	—	4. Repairs, upkeep and extension of buildings and cages	...	605	214
5. Gate Receipts (29-12-02 to 27-12-03, inclusive)	...	1,217	110	5. Purchase of new animals	...	181	613
6. Elephant rides	...	33	730	6. Printing and stationery	...	29	993
7. Camel rides...	...	2	380	7. Band	...	80	500
8. Sale of animals, eggs, etc.	...	21	681	8. Sundries (Permanent Advance Account).	...	121	061
9. Fines	...	—	500	9. Library Books	...	11	688
				10. Upkeep of Garden	...	216	132
				11. Return passage of temporary assistant	...	20	—
				12. Extra police, telephone and various	...	31	820
TOTAL RECEIPTS ...				TOTAL EXPENDITURE ...		4,504	526
				BALANCE CREDIT ...		109	561
				GRAND TOTAL ...		4,611	087

VIII. AQUARIUM.

As mentioned in last year's report the Aquarium at Gezira was opened to the public in November 1902.

A credit of L.E.120 was allowed by the Tanzim Service, P. W. D., to the Zoological Gardens for looking after the tanks and fish for the year 1903: but the actual expenditure only came to L.E.74.191 mills.

A list of the kinds of Nile fish which have been exhibited is appended, with some notes on them written up to 5th March, 1904, that may be of interest.

FAMILY MORMYRIDÆ.

1. *Marcusenius isidori*.—Anooma.

This quaint little blunt-nosed fish seems to bear captivity well. Individuals have certainly been ten months, possibly over fourteen months, in Tank No. 11, and are still thriving. There are fifteen or more specimens at present in this tank, each 2 to 3 inches in length. They spend most of their time suspended in mid water, with all their fins and tail in perpetual motion, but occasionally for a short time they will lie on the bottom of the tank with fins motionless. They feed on finely chopped-up earth-worms.

2. *Gnathomenus egyptioides*.—Anooma.

This species is also doing well in the Aquarium, several individuals have been from ten to fourteen months in Tank No. 21, and others have been recently added. At the present time there are thirteen specimens in the tank, the largest about 10 inches in length. Though in a state of nature their habits are apparently nocturnal, in captivity they soon learn to feed by daylight and eagerly devour the finely chopped-up earth-worms on which they are fed daily. They usually keep moving about the bottom of the tank, the pectoral and tail fins being almost constantly in motion, the other fins being only occasionally used.

3. *Mormyrus kannume*.—Abu boos.

The curious long-decurved nose of this fish at once attracts the attention of all visitors. Over thirty individuals, the largest about 12 inches in length, are living in Tank No. 16, a few of these have been now from eleven to sixteen months in the Aquarium, but the majority have been added early in 1904. From observations made on several specimens kept in the Director's House at Giza we find that naturally they spend the day lying quietly on the bottom of the tank but after nightfall become very active, searching energetically for food. When the light from a match or

lamp falls on them in the dark, their eyes shine very remarkably, sometimes white, sometimes gleaming red. They have a curious habit of swimming backwards with the tail leading. In the Aquarium they soon learn to feed by daylight, and it is an interesting sight to see them searching the bottom of the tank, examining every stone and cavity with their long snouts, for the pieces of chopped up earth-worms which are daily put in for them to feed on. Like many other species of fish they fight a great deal among themselves, and several individuals which died, from time to time during 1903, it is believed had been killed by their comrades; but latterly these fights have been less frequent. Like the *Gnathomemus* they prefer the lower part of their tank: the pectoral and tail fins are moved most, but there seems less of the constant waving of fins about this species than there is with the other two *Mormyridæ* mentioned above.

FAMILY CLUPEIDÆ.

4. *Clupea pinnata*.—Twait Shad, local name Saboorah.

This Mediterranean fish we know ascends the Nile as far as Cairo in the early months of the year. In the latter half of May, 1903, six very small fish caught at the Delta Barrage were purchased for the Aquarium, they apparently belong to this species, and are all still alive in Tank No. 8. They spend the whole day swimming rapidly hither and thither about their tank, moving so continually and quickly that the ordinary visitor to the Aquarium can hardly make out what manner of fish they are. The keepers say they eat bread.

FAMILY CHARACINIDÆ.

5. *Hydrocyon forskali*.—Kelb-el-Bahr, or Dog of the River.

Of the twenty-six species of fish that have so far been tried in the Aquarium this has been least successful. About eight specimens have been exhibited from time to time, they lived from seven weeks to four months, eat freely, appeared in good condition, and then generally died quite suddenly, for what reason has not yet been ascertained; which is curious as a specimen of *Hydrocyon brevix*, which has apparently similar habits, has done well under similar conditions of captivity. The Kelb-el-Bahr is very active and voracious, feeding only on live fish such as *Alestes*, which it pursues and captures with lightning-like agility and either swallows whole or bites right in half, swallowing the half seized. It is found necessary to keep a lamp burning near their tanks all night as if left in complete darkness they damage themselves swimming violently against the walls of the tank, but with a glimmer of light they avoid this. There are a few of these fish in the ornamental water of the Selamluk side of the Zoological Gardens, the largest specimen observed measured

20½ inches (52 centimetres) in length overall and weighed 2½ lbs. (1·2 kilos.); it was taken alive to the Aquarium, 8th April, 1903, but only lived a few months. Although expensive to feed it is a great pity these fish have not so far done better in captivity, as they are very graceful in form and beautiful in colour, silvery bodies with black longitudinal lines and red tail fins: their large teeth which show even when the mouth is closed give them a very ferocious expression which their habits do not belie.

6. *Hydrogon brevis*.

Of this rare species only one specimen has been obtained, it was purchased 10th November, 1902, and is still alive (5th March 1904), in Tank No. 17. In habits it resembles *H. forskali*, feeding only on small live fish. It is silvery in colour, with about nine more or less distinct longitudinal black lines on each side of the body, the posterior edge of the tail fin is also black, and the lower lobe of the tail fin red.

7. *Alestes kotschyi*.—Wri.

Of this beautiful, silvery, salmon-like fish, with a conspicuous red patch on the lower lobe of the tail fin, sixteen individuals which were obtained in October 1902, are living in Tank No. 18; the largest specimen is about nine inches in length. They feed freely on bread daily. They are an active fish, never lying on the bottom of the tank but keeping to mid water or swimming close under the surface. Besides those in the Aquarium there are several in both the Haremlik and Selamlık waters in the Zoological Gardens: the largest specimen noted was 18½ inches (46·3 centimetres) in total length overall and weighed almost 2 lbs. (·9 kilos.). When the Esbekia Lake, Cairo, was emptied 12th September 1903 two specimens of Wri were found each measured 21¾ inches (55·24 centimetres) in total length overall and weighed 3·85 lbs. (1·75 kilos.).

8. *Alestes nurse*.—Sardeena.

This is a deeper fish than the Wri, with sometimes a dark spot on either side of the tail. Three specimens were purchased in the Autumn of 1902, and are still alive: one in Tank No. 18 is about five inches in total length, and in Tank No. 9 there are two smaller ones, these latter have grown very considerably during their life in the Aquarium. They resemble the Wri in habits, and are fed on small pieces of bread.

FAMILY CYPRINIDÆ.

9. *Labeo niloticus*?—Berbis.

This is an inconspicuous, small, dark-coloured species of Carp, which keeps chiefly to the bottom and sides of the tanks and is fond of hiding away in crevices: it is fed on bread. Four individuals were obtained 7th August 1902, two more 5th November 1902, and two about 15th April 1903; it is believed they are all still alive in Tanks Nos. 2 and 24.

10. *Labeo jörskuli*.

Another small Carp of similar habits to the last species, from which it is distinguished by the high falcate dorsal fin and very lumpy nose. A specimen purchased in the autumn of 1902 is still alive in Tank No. 2, and is apparently growing in size.

11. *Labeo horie*?—Libees.

This fine Carp seems to be one of the commonest fishes in the neighbourhood of Cairo, and attains a large size. Large specimens transferred to the Aquarium have, as was perhaps to be expected, not done well, developing a white fungus-like growth on their scales and over their eyes, but young individuals do well and increase rapidly in size, feeding on bread. Having had to be occasionally shifted from one tank to another, as the tanks were required for other purposes, it is not certain how long any individual Libees has lived in captivity, but some now thriving in Tank No. 24 have certainly been in the Aquarium over a year. This species occurs in both the Haremlik and Selamlık waters in the Zoological Gardens; a specimen caught 8th April 1903, was 25 inches (63·5 centimetres) in total length overall, and weighed 6·17 lbs. (2·8 kilos.), and one caught 3rd September 1902 whose length was, unfortunately, not recorded weighed 8·25 lbs. (3·75 kilos.). In emptying the Esbekia Lake, 12th September 1903, many specimens were found: the largest was 24½ inches (62·32 centimetres) in total length overall and weighed 7·3 lbs. (3·3 kilos.).

12. *Barbus bynni*.—Bynni.

The Egyptian Barbel does well in captivity. Five specimens lived in the Aquarium from 26th December 1901 to 1st January 1903 (one year and five days) when they were accidentally killed by the tank running dry during the night. More specimens were obtained, 7th to 13th January 1903, which are now alive in Tank No. 24; they are fed on bread. In emptying the Citadel Pond in the Zoological Gardens, 29th March 1903, only two Bynni were found, the larger of these measured 11½ inches (29·2 centimetres) in total length overall, and weighed 0·55 lbs. (0·25 kilos.); but when the Esbekia Lake was emptied, 12th September 1903, a large number of Bynni were caught, four of the finest specimens measured:

<i>Total length overall</i>	<i>Weight</i>
25 inches (63·5 centis.)	9·26 lbs. (4·25 kilos.)
26½ inches (67·3 centis.)	9·91 lbs. (4·5 kilos.)
25½ inches (64·7 centis.)	11 lbs. (5 kilos.)
26 inches (66 centis.)	12·35 lbs. (5·6 kilos.)

This last fish Mr. G. A. Boulenger refers to in "The Field," No 2653, of 31st Oct. 1903, as being the largest of its kind on record.

15. *Barbus perince*.

This Barbel seems only to attain a length of about three inches, and is conspicuous by the black spots on each side of the silvery body: there appear to be usually three of these spots, sometimes two or four, and rarely as many as seven. It does well in captivity either in a small glass bowl or in a large aquarium tank, feeding readily on bread-crumbs, biscuits, etc. The numerous specimens in Tank No. 9 were caught in August 1902. There are also individuals in No. 24 and other tanks, in one or two of which it is believed this species bred (and the young fish grew up) in the summer of 1903, as it does in Selamlık canal of the Zoological Gardens.

FAMILY SILURIDÆ.

14. *Clarias lazera*.—Armoot.

Two specimens caught in the reservoir of the Giza Water Works, 26th December 1901 are still alive (5th March 1904) in tank No. 23, and are each about twenty-three inches in length; and in Tank No. 14 there are about twenty-four specimens, from about ten to sixteen inches in length, purchased in August 1902. These fishes are fed on raw meat, and eat large quantities of it; after a meal the distended stomach quite alters the general appearance and shape of the fish. With a sufficiency of food a crowd of individuals will live amicably together, but hunger leads to internecine warfare.

A species of *Clarias*, either *C. lazera* or *C. anguillaris* occurs in the Selamlık Canal of the Zoological Gardens, on the 23rd Sept. 1903 four small specimens were caught, one of which was placed in No. 23 Tank but has not been seen since; on the 21st February 1904 a specimen was found dead, choked by a *Synodontis schal* which it had attempted to swallow, this *Clarias* measured 45½ inches (1·15 metres) in length and weighed 22 lbs. (10 kilos.), and on 22nd February 1904 another specimen was found dead which measured 48½ inches (1·23 metres) in length and weighed 22·7 lbs. (10·3 kilos).

15. *Entropius* sp.

The specimens of this fish in Tank No. 6 have not been seen for several months.

16. *Schilbe mystus*.—Schil Bayer.

17. *Siloranodon auritus*.—Widamah.

There are several specimens of these two species in Tank No. 6 where they have lived over a year and appear to have increased considerably in size; they are fed on bread.

18. *Bagrus bayad*.—Bayad.

Although of curious appearance, on account of its extremely long "whiskers," the Bayad seems of little exhibition value, the smaller specimens

spend the whole day completely hidden in the crevices of the rock-work of the tanks, and the larger ones, unable to hide away, lie motionless hour after hour: they have not been observed to eat, but it is found that raw meat placed in their tank over night disappears before morning: large specimens have lived over ten months in the Aquarium, and of the five small specimens now in Tank No. 4 about three have probably been there considerably over a year. When the Esbekia Lake was emptied, 12th Sept. 1903, many Bayad were found, one of the finest specimens measured 26 inches (66 centis.) in total length without including the tails filaments, and weighed just over 6 lbs. (2.75 kilos.)

19. *Chrysichthys auratus*.—Abu Rial.

In Tank No. 18 there are about seven individuals who have been there since the latter part of 1902, they spend the whole day completely hidden in the crevices of the rock-work except when they are fed when they come out into the daylight, eagerly eat pieces of bread, and then retire again completely out of sight.

20. *Synodontis schall*.—Schall.

This thick-set blackish fish with armoured head and feeler-bestudded mouth is very numerous near Cairo: it is armed with three terrible spines, one on the dorsal fin and one on each pectoral fin, which give many bad wounds to men working in the water with bare feet and hands. About fifty specimens, varying from 2 or 3 to 13 inches in length from nose to fringe of tail-fin are living in Tank No. 15, some of these have been in the Aquarium certainly since August 1902 and probably since March 1902. At first it was found that the smaller specimens worried and injured the larger ones by eating their skin, especially about the dorsal fin, but for some months now this has stopped, the supply of artificial food being probably better regulated. The Schall are fed on bread and meat.

Many Schall were found in the Esbekia Lake when it was emptied 12th Sept. 1903, the largest specimen measured 15½ inches (39.36 centis.) from nose to extreme end of tail-fin and weighed 1.66 lbs. (.75 kilos.) Equally large specimens have been found in the Zoological Gardens, where this species lives in both the Haremlik and Selamlik waters.*

21. *Malopterurus electricus*.—Raa-Ard.

An Electrical Fish purchased 24th November 1902, only lived three months and four days in the Aquarium having died 28th February 1903. In April 1903, two more were purchased and placed in Tank No. 22, where they are still alive and apparently in good health (7th March 1904). Two more have recently (February and March 1904) been received and placed in Tank No. 12. These fish appear to spend nearly the whole day lying

*N.B. On the 7th March 1904 an Albino Schall, about 7 inches long, was purchased: a beautiful fish, white all over with pink shades, and black eyes.

motionless on the bottom of the tank, from time to time flapping their pectoral fins. Both the Director and some of the keepers having received strong electrical shocks from comparatively small fish of this species kept at the Director's House : they have not cared to experience how powerful a shock the large fish in Tank No. 22 may be able to give.

FAMILY MURENIDÆ.

22. *Anguilla vulgaris*?—Taban samak.

Five Eels caught at Giza in March 1902 were placed in Tank No. 1, and eleven more added during the summer of 1902. One or two can generally be seen in this tank, but whether the whole sixteen are still alive is not known, as the rockery in the tank affords them numerous places for concealment.

FAMILY SERRANIDÆ.

23. *Lates niloticus*.—Ishr, or Great Nile Perch.

In the last months of 1901 and earlier part of 1902 when experiments were being made in keeping the Nile fish in captivity this species appeared to be the most difficult of all to manage. Large specimens caught and put in the Aquarium tanks, although they would feed, would only live a few days or weeks : but when in the early autumn of 1902 the young *Lates* of the year appeared in the Selamlík Canal of the Zoological Gardens several were caught and taken to the Aquarium, where some flourished and grew rapidly in size while others completely vanished and there is little doubt they were eaten by their brethren.

There are now (5th March 1904) in the Aquarium in Tank No. 5 one very small Ishr, in No. 7 one medium-sized specimen caught in the Esbekia Lake 12th September 1903, in No. 20 four young individuals the largest about $10\frac{1}{2}$ inches in total length, one at least of these has been in this tank since October 1902, and in Tank No. 24 there is also one small specimen.

Their natural food appears to be live fish only, but it is found they will eat freshly dead fish, such as *Alestes*, thrown into the tanks, seizing them as they sink and swallowing them whole. One of the most noticeable points about the Ishr is its gleaming eyes, which in some lights glow red like dull signal lamps : another is its power of rapidly changing its colour, and the appearance and disappearance of dark markings all over the sides of the body—further observations are wanted concerning when and how this is carried out.

As is well known this species attains to a great size, but it is surprising how large it grows in quite small pieces of water. It occurs in both the Haremlík and Selamlík waters of the Zoological Gardens. On the morning of 3rd February 1904, after a very cold night, a specimen was found dead

in the Lotus Lake which measured in total length $13\frac{1}{2}$ inches (1'114 metres) and weighed 36'37 lbs. (16'5 kilog.). On the 12th September 1903 when the Esbekia Lake was emptied many small and medium-sized *Lates* were caught and one monster who measured in a straight line from point of lower jaw to end of tail fin 48 inches (1'219 metres) and weighed 55 lbs. (25 kilos).

FAMILY CICHLIDÆ.

24. *Tilapia nilotica*.—Boliti.

This Perch-like fish lives very well in captivity in anything from a wide-necked glass bottle to a large tank; it eats readily insects, meat, bread, biscuit and various plants, and large specimens probably eat small live fish also, in fact anything they can get. Different from most fish, large specimens newly caught and placed in the Aquarium will do well; a Boliti of the largest size caught at Giza 16th March 1902 lived ten months and twelve days in Tank No. 1, dying then probably not from the results of captivity but from cold. The Boliti is very susceptible to a fall of temperature, both in the Aquarium tanks and in the ponds of the Gardens a sudden spell of cold weather kills large numbers, and after even one degree of frost at night hundreds of these fish are found dead in the canals. This winter therefore Tank No. 1 was protected by glass to prevent the cold air reaching the surface of the water, which consequently maintained a slightly higher temperature than it would have otherwise done and the fish did much better. The largest specimen noted from the Zoological Gardens was 16 inches (40'6 centim.) in length and 4'18 lbs. (1'9 kilog.) in weight, and from the Esbekia $17\frac{1}{2}$ inches (43'8 centim.) and 3'85 lbs. (1'75 kilog.).

FAMILY TETRODONTIDÆ.

25. *Tetrodon fahaka*.—Fahaka.

In Tank No. 10 there is a Globe Fish that was caught 21st July 1902, so has now been over one year and seven months in captivity and is still thriving; this specimen will not allow any other fish to share its tank, attacking them fiercely. In Tank No. 19 there are three smaller specimens obtained respectively on 21st October 1902, 10th November 1902 and 6th January 1904. They are fed on raw meat.

As du ing 1902, Mr. G. A. Boulenger, F.R.S., of the British Museum, and Mr. W. L. S. Loat, lately Inspector of Nile Fish, kindly gave information on many points concerning the above fish.

Besides the Nile Fish specimens of Gold-fish *Carassius auratus* are also exhibited. In tank No. 13 there are about nineteen ordinary sized specimens which were purchased in November 1901, and also one large individual which was caught in the Esbekia Lake, 12th Sept. 1903, and is about eleven inches in length and very fat.

Some fresh-water crabs caught in the Nile have also been placed in the Aquarium, but owing to their retiring habits are seldom seen, but at least one individual it is certain has lived over a year there and is believed to be still in Tank No. 13: Dr. J. G. de Man has kindly identified this species as *Potamon (Parathelphusa) niloticum*, H. M.-E. A species of Shrimp found in the Nile has also been exhibited and specimens sent to Dr. de Man.

IX.—APPENDIX.

4. The following report on the butterflies occurring in the Zoological Gardens has been kindly written by Mr. Philip P. Graves, of Cairo.

List of Butterflies taken or observed in the Giza Zoological Gardens.

FAMILY PIERIDÆ.

1. *Pieris rapæ*.—Common in all months.
2. *Euchlor belemia*.—End November to April. Occasionally enters Gardens from neighbouring fields. Food plant Mustard, Ernea, and other Crucifere.
3. *Colias edusa*.—Most months of the year. Occasionally common in the Gardens. Food plant. Various kinds of clover.

FAMILY NYMPHALIDÆ

4. *Pyrameis atalanta*.—The neighbourhood of the Zoological Gardens seems to be the chief stronghold of this fine species in Cairo. It is far more common at Alexandria.
5. *Pyrameis cardui*.—†Always abundant and swarms in autumn. Food plant. Thistles.
6. *Danaïs chrysippus*.—This fine butterfly is very abundant at all seasons in the Zoological Gardens. It is a variable species and I have heard that the form with white posterior wings *Danaïs var. albippus* has been seen there.

FAMILY LYCÆNIDÆ.

7. *Hypolyrana livia*.—I feel a little doubt about including this species since, when in flight, No. 8 may be mistaken for it. I have however seen it in all the chief gardens in Cairo E. of the River and at Zeitun, etc. The Larva feeds on the "Sūnt" Acacia and on *Acacia farnesiana*, boring into the pods whose seeds and pith it devours. Occurs from early summer to November.
8. *Lampides batheus*.—Common in summer and often occurs in the winter months. Food plant. Vetches and *Collutea*.
9. *Lampides telicæus*.—Summer and autumn. Very abundant August and September. Food plant. Vetches and *Alhagi mannifera*.

*"Red Admiral". †"Painted Lady."

10. *Chilades trochilus*.—One male seen. A local species about Cairo occurring in spring and from August to October.

11. *Lycotus lysimon*.—Abundant throughout the year except January and February.

FAMILY HESPERIDÆ.

12. *Paratraz mathias*.—Common in spring, summer and autumn. This species has a habit of sunning itself on the hottest stones in rockeries and on pathways. Female oviposits on grasses.

I think it highly probable that *Paratraz nostradamus*, a common species in the Barrage and Ezbekia Gardens, and *Lampides theophrastus* are also to be taken in the Giza Zoological Gardens.

The small number of species in the above list would be remarkable in any country but Egypt. The absence of woods and of waste ground covered with vegetation and the very thorough cultivation and flooding of the fields accounts for this paucity. Of the 12 species given in the above list 9 certainly oviposit on common crop plants or weeds of cultivation. Thus far I have taken or observed 20 species in the neighbourhood of Cairo—including Marg and Helwan. Two of these—*Hypolygona livia* and *Lampides theophrastus* are East African and Arabian species, though the latter extends in the west to Andalusia. Two—*Melitæa var deserticola* and *Lycotus allardi*—have only been recorded previously from the interior of Algeria and Morocco. *Pieris glaucanome* is a desert species ranging from the Sinai and the Persian Gulf to Shendi or further and the remainder are wide-spread Mediterranean or Cosmopolitan species without exception. Thus, omitting the better-known forms, *Paratraz mathias* ranges from Cyprus to Malaya, *Lycotus lysimon* from Andalusia and the Riviera to India, and *Ch. trochilus* from the Balkans to North Australia. The Maryut District and the "Wadis" of the Arabian and perhaps the Lybian desert seen to me the most promising localities for the collector, and it would be most interesting to know at what point in Upper Egypt the desert butterflies of the Sudan begin to occur.

P.P. Graves. 27th Nov., 1903.

B.—List of Publication of the Zoological Gardens.

Report for the year	...	...	...	1899	Price P.T.5 (one shilling)
"	"	"	...	1900	" P.T.5
"	"	"	...	1901	(out of print).
"	"	"	...	1902	" P.T.5
Guide-book, 1st Edition (published 14.12.02)					(out of print).
"	2nd	"	(	18.12.03)	" P.T.5

* "Blue".

"A book that is shut is but a block"

CENTRAL ARCHAEOLOGICAL LIBRARY

GOVT. OF INDIA
Department of Archaeology
NEW DELHI.

Please help us to keep the book
clean and moving.

S. B., 148, N. DELHI.